

PETROLEUM RESOURCES OF THE WORLD

BY

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PREFACE

THIS work is intended as a concise record of salient facts related to the producing and prospective oil fields of the world and to the countries in which these fields are located.

The material presented has been collected largely during the author's personal investigations of the oil regions of the United States, Mexico, Central and South America, Europe and Africa, while he was acting as manager of the foreign oil interests of Henry L. Doherty & Company. The author wishes to express to this firm his deep appreciation for their broad-minded attitude in permitting the publication of the results of these investigations.

The author takes pleasure in acknowledging the assistance rendered by Mr. C. A. Tornel in reviewing the material on petroleum legislation; and by Mr. Harold E. Boyd and other members of the Oil & Natural Gas Department of Henry L. Doherty & Company for their valuable help and information.

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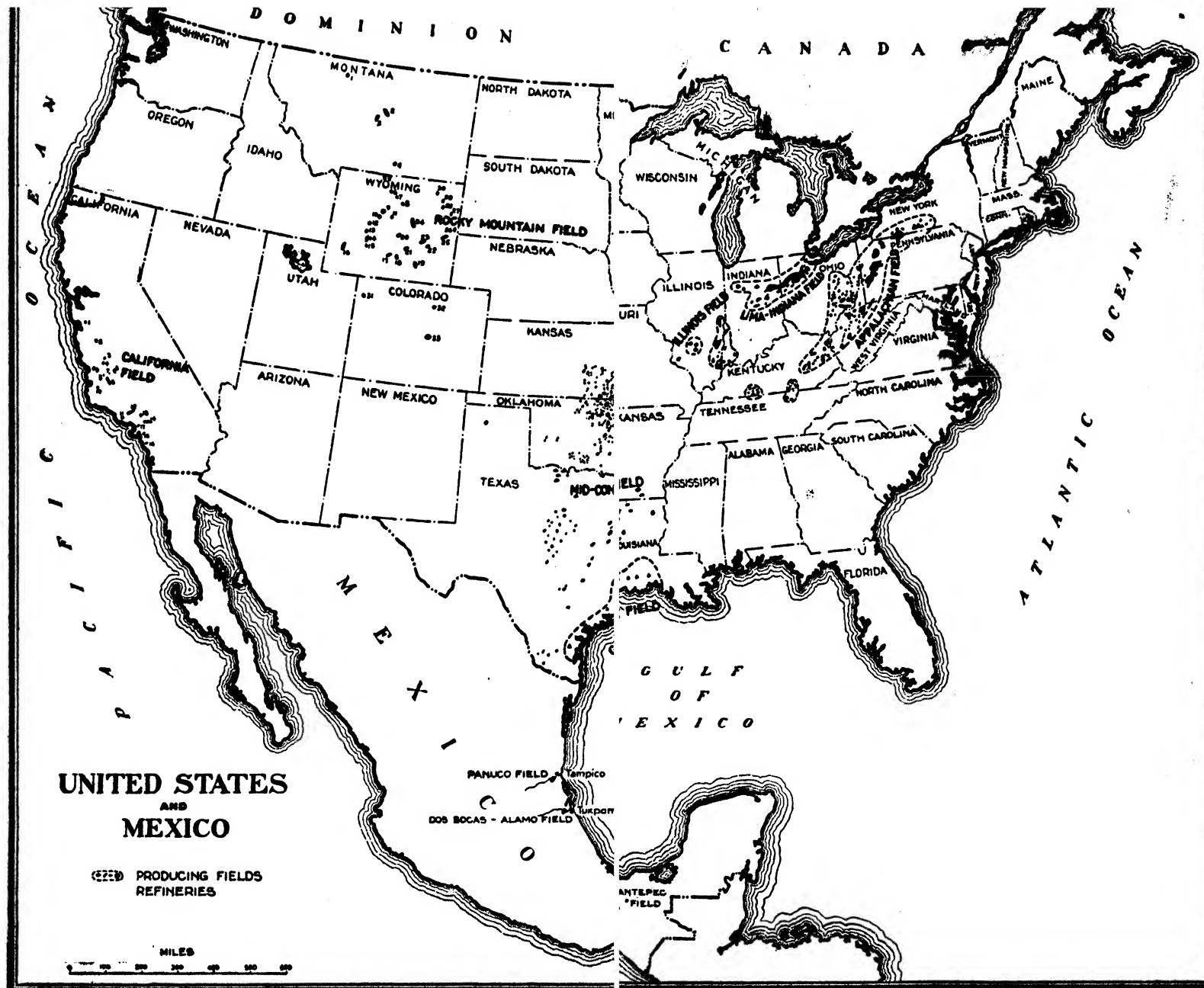
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INTRODUCTION

It is a fact, well known to petroleum operators, that the commercially producing oil fields, so far discovered after years of prospecting, are very few in comparison with the number of the regions explored and with those in which petroleum indications are known to exist. It is also true that, of the producing districts, the large majority are of local importance only, and that the present magnitude of the industry is due mainly to the wonderful productivity of the United States and Mexico which combined represent about 90 per cent of the world's total.

In the writer's opinion, the future of the oil industry is secure for a reasonably long time, notwithstanding the reports of the alarmists to the contrary. A survey of the promising prospective oil regions of the world clearly shows the great potentialities of untested areas and further demonstrates the magnitude of the oil reserves. Although in exceptional cases it is possible to predict with accuracy the economic life of particular pools, the estimates of reserves even in producing regions are for the most part misleading conjectures.

Petroleum legislation in most countries is in a transitory and very unsatisfactory state and, until these conditions are remedied, the further development of some producing regions will be delayed and the testing of many favorable areas indefinitely postponed.



PETROLEUM RESOURCES OF THE WORLD

PRODUCING FIELDS

UNITED STATES

INTRODUCTION

THE United States of America has an area of 3,026,000 square miles and a population of 105,700,000, with a density of 35 per square mile. Transportation and communication facilities include 264,000 miles of railroad, 26,000 miles of navigable rivers, 6000 miles of canals, 250,000 miles of telegraph line, and 21,000,000 miles of telephone line.

The country declared her independence of Great Britain in 1776, but the Constitution now in force was not adopted until 1787. The Government is a federal republic, divided into executive, legislative, and judicial departments. The President is elected for a four-year term, and constitutionally may be re-elected any number of times, but custom decrees a maximum of two terms. The National Debt is approximately \$22,691,000,000, or \$214.67 per capita.

The United States is the largest producer and consumer of many staples, and leads the world in the production of cereals, cotton, petroleum, coal, iron, aluminum, copper, zinc, and lead. The chief exports, in order of their importance, are cereals, iron

and steel manufactures, raw cotton, petroleum, meat and dairy products, and coal; the chief imports are sugar and molasses, silk, coffee, lumber, and petroleum. The export trade is carried on principally with Great Britain, Canada, France, and Cuba; and the import with Canada, Cuba, Great Britain, Japan, and Mexico.

PETROLEUM RESOURCES

General Statement.—The United States has held first place in the production and consumption of petroleum during the last sixty-two years, except from 1898 to 1901 when Russia held the lead; and it bids fair to occupy this position for many years to come. It so far surpasses all other countries in the magnitude of its oil resources that it makes other fields appear unimportant by comparison.

The producing oil fields of the United States are situated in the Appalachian Plateau, the Central Plain, the Gulf Coast Plain, the Rocky Mountain region, and on the Pacific Coast in California. The Appalachian Plateau and the Central Plain lie between the Appalachian Mountains on the east and the Rocky Mountains on the west, and in this broad region are located the Appalachian, Lima-Indiana, Illinois, and Mid-Continent Districts; the Gulf Coast District includes the pools along the Gulf of Mexico; the Rocky Mountain District includes the fields in Wyoming, Montana, and Colorado; the California District includes the fields in the central valley and in the coast belt of southern California.

Development and Production.—All drilling in the American oil fields is done either by the standard or rotary, both typical American methods, which are being constantly improved. A combination of standard and rotary is also successfully employed. Oil is recovered from the underground reservoirs either by natural flow, as in some of the California, Wyoming, and Mid-Continent fields; by pumping, which is the most common method; or by air lift, in fields where water encroachment makes necessary the recovery of large volumes of fluid. Bailing, as resorted to in the

Russian and Roumanian fields, is not carried on in the United States.

The production of individual wells varies within wide limits, from the gusher in the California fields producing 50,000 or 60,000 barrels per day to the pumping well of the Lima-Indiana District yielding one-third of a barrel per day. The average well production by districts ranges from 49 barrels per day in the Rocky Mountains to one-third of a barrel per day in Lima-Indiana. The total number of producing wells is about 280,000, and the average daily production per well is about $5\frac{1}{2}$ barrels. About 45 per cent of these wells are in the Mid-Continent District. On an average, over 5000 wells are in process of drilling, and about 15 are abandoned daily.

The production of petroleum in the United States since 1890 is shown in the following table:

PRODUCTION OF PETROLEUM IN THE UNITED STATES

(in U. S. barrels)

1890	45,823,572	1907	166,095,335
1891	54,292,655	1908	178,527,355
1892	50,514,657	1909	183,170,874
1893	48,431,066	1910	209,557,248
1894	49,344,516	1911	220,449,391
1895	52,892,276	1912	222,935,044
1896	60,960,361	1913	248,446,230
1897	60,475,516	1914	265,762,535
1898	55,364,233	1915	281,104,104
1899	57,070,850	1916	300,767,158
1900	63,620,529	1917	335,315,601
1901	69,389,194	1918	355,927,716
1902	88,766,916	1919	378,367,000
1903	100,461,337	1920	442,929,000
1904	117,080,960	1921	472,183,000
1905	134,717,580	1922	551,197,000
1906	126,493,936		

Transportation of Petroleum.—With the exception of the Rocky Mountain fields, all important districts east of the Rocky Mountains are connected with each other, and with the Atlantic

and Gulf Seaboards, by a very complete pipe line system. The pipe lines, which aggregate in length about 60,000 miles, are operated continuously, day and night.

The Appalachian and Lima-Indiana pipe line system, consisting of one 8-in. and one 6-in. line, with a total capacity of 30,000 barrels, gathers the oil from various fields in the districts and reaches the Atlantic Seaboard at New York and Philadelphia where important refineries are located.

The Illinois District is likewise connected with the Atlantic Seaboard refineries and with the Great Lakes by pipe lines.

The Mid-Continent District is connected with Chicago by two 12-in. and two 8-in. lines, with Kansas City by one 8-in. line, with a total daily capacity of 60,000 barrels. The main pipe line terminals on the Atlantic Coast are in and around New York and Philadelphia, while the terminals on the Gulf Seaboard are near Galveston, Texas, and at Baton Rouge, Louisiana, on the Mississippi. By the use of these lines, the production of the Mid-Continent District can be directed at will to other fields, to interior marketing centers like Chicago or St. Louis, or to the terminals on the Atlantic or Gulf Coasts.

The Wyoming fields are not at present connected by pipe lines with the main system, but a line under construction will link the district with important trunk lines near Kansas City.

The California fields are amply provided with pipe line transportation to the refineries on San Francisco Bay and points south.

The Interstate Commerce Commission estimates that the total investment represented by the pipe line system, exclusive of California, aggregates about \$652,000,000. There are about 55,000 miles of line represented which shows an average cost of \$6600 per mile. The Prairie Pipe Line Company with over 10,000 miles easily leads the list.

Although practically every important field is connected by pipe line with marketing centers, refineries, or seaboard terminals, a considerable part of the crude and refined oil must be transported in railroad tank cars, either for use by the railroad or for delivery along the route. For this service there are about 135,000 cars,

ranging in capacity from 190 to 255 barrels per car, with the greatest number carrying about 200 barrels each. The carrying capacity of all the available tank cars is approximately 27,000,000 barrels.

The following table shows the pipe line capacity of the United States:

THE OIL PIPE LINE SYSTEM OF THE UNITED STATES

District	Terminal	Pipe Lines		
		No	Diameter, Inches	Daily capacity
Appalachian	Atlantic Seaboard	{ 5	8	100,000
Lima-Indiana		{ 1	6	10,000
St. Louis	Ohio State Line	{ 1	8	20,000
Chicago		{ 1	12	36,000
		{ 1	8	20,000
		{ 1	10	28,000
		{ 2	12	70,000
		{ 2	8	40,000
Mid-Continent	Kansas City	1	8	20,000
	Gulf Coast, Texas	4	8	80,000
	Gulf Coast, Louisiana	1	8	20,000
	San Francisco Bay	5	8	130,000
California	Los Angeles	1	8	30,000
Valley Districts	Monterey	1	6	15,000
	Port Harford	2	8	50,000
	Port St. Luis	1	8	20,000
California	Gaviofa	1	8	15,000
Coast Districts	Port Hartford	{ 1	8	40,000
		{ 1	6	
	Los Angeles	{ 3	8	100,000
		{ 1	6	

Water transportation of petroleum in the United States is chiefly confined to the shipping of oil in tank steamers from the terminals along the Gulf Coast to the Atlantic Seaboard. This is made necessary because of the limited pipe line transportation

facilities to the Atlantic Seaboard in comparison with the demands of that region.

Storage Facilities.—Crude and refined oils are stored in tank farms at the field, at refineries, at marketing stations, in pipe line pump stations, and in the lines themselves. The total amount of oil in storage in the United States has been steadily increasing for many years, until at the end of 1922 the figure of 400,000,000 barrels was reached. In order to grasp the true significance of these figures, they should be interpreted in relation to the increased home consumption and foreign demands. Such an analysis shows that during the last five years, the total stocks could provide (assuming that production and imports should abruptly cease) for an average of about six months' home consumption and exports, and that the lowest factor of safety afforded by stocks prevailed during August, 1920, when the total storage represented only about four months of total needs; the highest figures were recorded in January and April, 1922, when stocks represented a safety factor of about nine months. It is interesting to note, further, that the average price of crude oils in the United States closely follows, in an inverse ratio, the fluctuations of the month's supply in storage curve.

The total storage capacity of crude and refined products in the United States is not accurately known, but it is estimated that there was, at the end of 1922, about 20 per cent capacity in excess of the utilized storage, which would bring the total storage capacity close to 480,000,000 barrels. By far the greatest portion of the stock is stored in steel tanks with an average capacity of 55,000 barrels each.

Refineries.—There are over 500 refineries in the United States, with an indicated daily capacity of 2,170,000 barrels, which is greatly in excess of the present production. These refineries may be grouped into eleven classes, ranging from the complete fractionation plants to those in which the crude is merely skimmed. Many of the important refineries are located at the pipe line terminals on the Atlantic, Pacific, and Gulf of Mexico Seabords.

The geographical distribution of the most important refineries is shown in the following table:

State	Daily Capacity in Barrels
Texas .	345,150
California . . .	314,360
Oklahoma .	234,000
New Jersey .	224,000
Pennsylvania . . .	114,930
Louisiana .	114,350

The location of the largest individual refineries is shown in the following table:

Location	Daily Capacity in Barrels
Bayonne, Linden and Jersey City, New Jersey	180,000
Port Arthur, Texas.	80,000
Point Richmond, California	60,000
Casper, Wyoming . . .	50,000
Philadelphia, Pennsylvania . .	50,000

Marketing.—The United States is the largest consumer of petroleum and its products in the world, and, large as the home production is, it has been necessary to supply the deficiency by imports from Mexico. It is estimated that about 75 per cent. of the Mexican output is marketed in the United States. About 5,500,000 barrels of petroleum products are exported each month from the United States, aggregating about 66,000,000 a year, an amount equal to the present combined yearly output of the Russian, Dutch East Indian, and Persian fields.

APPALACHIAN DISTRICT

General Statement.—The Appalachian District includes the fields of New York, Pennsylvania, West Virginia, southeastern and central Ohio, Kentucky, Tennessee, and northern Alabama. Its total length is about 500 miles, and its greatest width, in eastern Ohio, is about 150 miles. The area of greatest oil development

averages less than 50 miles in width and centers in the Panhandle of West Virginia.

Surface indications of oil are present at Oil Spring, Allegheny County, New York; Oil Creek, Venango County, Pennsylvania; the gas seep at Burning Springs, Wirt County, West Virginia; and the grahamite dike in Ritchie County, West Virginia. The reservoir rocks are mainly sandstones or conglomerate layers. The strata consist of preponderating shale, lenses of sandstone, which are the main oil and gas reservoirs, and subordinate limestone. The sandstones merge into shales toward the west, where there is also a greater proportion of limestone. There is a marked decrease in thickness of the strata, notably of the upper Devonian, toward the west. The rocks range in age from Ordovician to Carboniferous.

The Appalachian District is developed in a great geosyncline that lies west of the Appalachian Mountains and extends from southwestern New York to northern Alabama. On the west the strata rise to the Cincinnati arch in Ohio, Kentucky, and Tennessee. The pools occur generally in the axes and flanks of anticlines, parallel with the strike of the Appalachian Mountains, on minor terraces, and in water-free synclines. As a rule, the dips are less than 3° , although dips of 10° or 20° are occasionally observed. In New York, Pennsylvania, West Virginia, and Ohio there is little faulting in the fields, while in eastern Kentucky and Tennessee there are faults of considerable magnitude. Many of the folds yield gas only, and in general such folds lie east of the oil pools and nearer to the Appalachian Mountains.

Development and Production.—The first serious attempt to develop the petroleum resources of the Appalachian region, the pioneer oil field of the United States, resulted from the drilling of a well at Titusville, Pennsylvania, by E. L. Drake in 1859. Although it was not a large producer, there was a sale for the oil and other wells were soon drilled opening adjoining pools. The first flowing well, or gusher, was sunk near Rouseville in 1860, and several others yielding from 3000 to 4000 barrels per day were brought in during 1861. Development in this region thereafter

was rapid, reaching a maximum in 1891; from that time it has slowly declined. At the present day the most productive portion of the district lies in New York, Pennsylvania, and West Virginia.

The production of the Appalachian District since 1890 is shown in the following table:

PRODUCTION OF PETROLEUM IN THE APPALACHIAN DISTRICT

(in U. S. barrels)

1890 .	30,066,560	1907 .	25,342,137
1891	35,848,777	1908 . . .	24,945,517
1892	33,432,377	1909 .	26,535,844
1893	31,365,890	1910	26,892,579
1894	30,783,424	1911 .	23,749,832 .
1895	30,960,639	1912 .	26,338,516
1896	33,971,902	1913 .	25,921,785
1897	35,230,271	1914	24,101,048
1898	31,717,425	1915 .	22,860,048
1899	33,068,356	1916	23,009,455
1900	36,295,433	1917	24,932,205
1901	33,618,171	1918	25,401,466
1902	32,018,787	1919	29,232,000
1903	31,558,248	1920 .	30,511,000
1904 .	31,408,567	1921	30,574,000
1905 .	29,366,960	1922 .	29,204,000
1906 . .	27,741,472		

The typical Appalachian oil is of high grade, rich in lighter derivatives, of paraffin base, and remarkably free from sulphur. It has a gravity of 39° to 45° Bé. (0.828 to 0.80 sp. gr.) and contains about 35 per cent gasoline, 27 per cent kerosene, 10 per cent gas oil, and 15 per cent lubricating oils.

Prospective Fields.—The great number of wells drilled to date have tested practically the entire district, and the material increase of the present production is not to be expected; nevertheless, it is quite likely that new isolated productive areas will be discovered, and that deeper drilling will prove the presence of reservoirs under some of the present producing areas. It is expected that the production of these fields will continue its gradual decline in line with their past history.

OHIO GAS FIELDS.—In an extension of the Appalachian field in eastern Ohio, the petroliferous strata in western Pennsylvania and West Virginia are present, and west of this belt is the "Clinton-sand" gas field. The principal structural feature of the gas field is the steeply pitching anticline west and southwest of Wooster, along the crest and flanks of which the gas has accumulated.

The Clinton gas field is one of the largest sources of natural gas in the world; it was discovered at Lancaster in 1887, and the field has been developed so that it now extends from the shore of Lake Erie southward almost to the Ohio River. In 1912, the output of natural gas in Ohio exceeded 56,000,000,000 cu. ft.; the value was nearly \$12,000,000, and probably 90 per cent of this came from the Clinton field.

LIMA-INDIANA DISTRICT

General Statement.—The Lima-Indiana District includes the fields in northwestern Ohio and northeastern Indiana and extends with interruptions from Lake Erie to a point near Marion, Indiana. Its width varies from less than 1 mile to 20 miles or more.

Surface indications of oil and gas led to the development of the district. Prospecting was first carried on in the vicinity of Findlay, Ohio, where, as early as 1838, natural gas from springs was utilized for domestic purposes. The oil-bearing strata consist of lenses in the Trenton limestone, of Ordovician age, in which the original limestone has been changed to a porous dolomite. The pools are very irregular in shape, differ greatly in size, and in many places entirely surround barren areas. In southwestern Indiana there are a number of detached pools in which oil is obtained from limestone of the Devonian system and from sandstone.

The structure of the Trenton limestone has a marked relation to the production of oil. The region is a broad, flat-topped anticline, subsidiary to the Cincinnati arch, on the crest of which the oil occurs in minor undulations. The Cincinnati axis forms a Y, with the stem crossing the Ohio River near Cincinnati. In Ohio,

part of the richest territory has been found on this arch, while in Indiana it does not appear on the summit of the arch, but on the north flank. The fractured and dolomitized Trenton limestone, which contains the oil and gas, underlies the Utica shale. In general, the gas lies about 950 to 1200 ft. deep, and the oil a little deeper, and both are near the top of the Trenton or not more than 100 to 200 ft. down in it.

Around the gas field, salt water rises to nearly equal elevations on all sides. The Cincinnati arch is a dome surrounded by a large basin; the water flows down the slopes of the basin and rises in the arch, pushing oil and gas ahead of it, and equilibrium is established by the back pressure of gas when it equals the water pressure.

Development and Production.—The output from the Ohio fields of this district attained its maximum in 1896, when it exceeded 25,250,000 barrels. The maximum production in Indiana was reached in 1904, when the yield was about 11,300,000 barrels. The pressure and production have greatly declined in recent years.

The production of the Lima-Indiana District since 1890 is shown in the following table:

PRODUCTION OF PETROLEUM IN THE LIMA-INDIANA DISTRICT
(in U. S. barrels)

1890	15,078,378	1907 .	13,121,094
1891	17,452,612	1908.	10,032,305
1892	15,867,575	1909.	8,211,443
1893	15,982,097	1910..	7,253,861
1894..	17,296,510	1911..	6,231,164
1895.	20,236,741	1912....	4,925,906
1896	25,255,870	1913..	4,773,138
1897	22,805,033	1914 .	5,062,543
1898.	20,321,323	1915.....	4,269,591
1899.	20,225,356	1916..	3,905,003
1900....	21,758,750	1917.....	3,670,293
1901... ..	21,933,379	1918.....	3,220,722
1902 ...	23,358,626	1919.....	3,444,000
1903. .	24,080,264	1920.....	3,059,000
1904 . .	24,689,184	1921.....	2,411,000
1905..	22,294,171	1922.....	2,256,000
1906..	17,554,661		

The oil is sulphurous, has a paraffin base, a gravity of 28° to 43° B \acute{e} . (0.886 to 0.81 sp. gr.), and contains 35 per cent gasoline, 15 per cent kerosene, 12 per cent gas oil, 9 per cent lubricating oils, and 25 per cent fuel oil.

Prospective Fields.—There are possibilities that the present limits of the fields may be extended and that the Trenton limestone may prove productive in isolated areas not yet tested by the drill; however, no material increase in the production is to be expected, and the present decline should continue.

ILLINOIS DISTRICT

General Statements.—The Illinois District includes the principal producing areas along the La Salle anticline in southeastern Illinois and a number of smaller fields in the central and western parts of the state.

Most of Illinois is covered with glacial drift and surface indications of oil or gas are meager. Near Chicago bitumen is found in the Niagara limestone, and in Calhoun County there is an oil seep in that formation, but neither of these regions supplies petroleum.

The producing sands of Illinois range in age from the top of the Carbondale formation of the Pennsylvania series down to the upper part of the Trenton limestone. The output is derived principally from the sandstones of the Pennsylvanian and the Mississippian. With minor exceptions, the producing beds are sands. Of all the producing beds in the state, those of the Chester group are the most irregular. The sands of the Pennsylvanian are extremely irregular in thickness and character. In the first producing field, the evidences were obtained by deep drilling for coal and by chance prospecting. In the Sandoval dome in Marion County, oil seeps along a fault into a coal mine.

Structurally, Illinois is a spoon-shaped basin with the tip lying in the northwest corner and the deepest part of the bowl in the southwest corner; the long axis extends northwestward, parallel with the main oil fields. From the main fields to the

basin, the dip is more pronounced. The most prominent dip is the La Salle anticline, which runs from Freeport to a point just east of the La Salle, and thence through the main oil fields and into Indiana. From western Illinois the rocks dip gently westward to the Duquoin anticline. East of the main oil field the strata rise gently in Indiana. In southern Illinois strong folds, faults, and igneous intrusions are present.

The production is obtained from sandstone and limestone layers in the Carboniferous. The pools on the La Salle anticline occur on its eastern flank. The most important oil-bearing territory lies in Clark, Crawford, and Allendale Counties.

Development and Production.—Development began in 1904 with a shallow well drilled in Clark County, which produced about 35 barrels per day; by the end of 1905, more than 1000 barrels per day were being marketed. The maximum output of nearly 34,000,000 barrels a day was reached in 1908. Since 1910 the production has declined at an average rate of 10 per cent each year.

The production of the Illinois District is shown in the following table:

PRODUCTION OF PETROLEUM IN THE ILLINOIS DISTRICT

(in U. S barrels)

1905	181,084	1914	21,919,749
1906	4,397,050	1915	19,041,695
1907	24,281,973	1916	17,714,235
1908	33,686,238	1917	15,776,860
1909	30,898,339	1918	13,365,974
1910	33,143,362	1919	12,436,000
1911	31,317,038	1920	10,772,000
1912	28,601,308	1921	10,935,000
1913	23,893,899	1922	10,211,000

The oil in this field has a gravity of 32.2° Bé. (0.863 sp. gr.) and contains 20 per cent gasoline, 15 per cent kerosene, 8 per cent gas oil, and 16 per cent lubricating oils.

Prospective Fields.—The limits of the Illinois District are well defined at present, and no appreciable increase of the pro-

ductive areas should be expected; however, there are possibilities of discovering new areas in the southwestern part of the state which may prove to be important additions in the future.

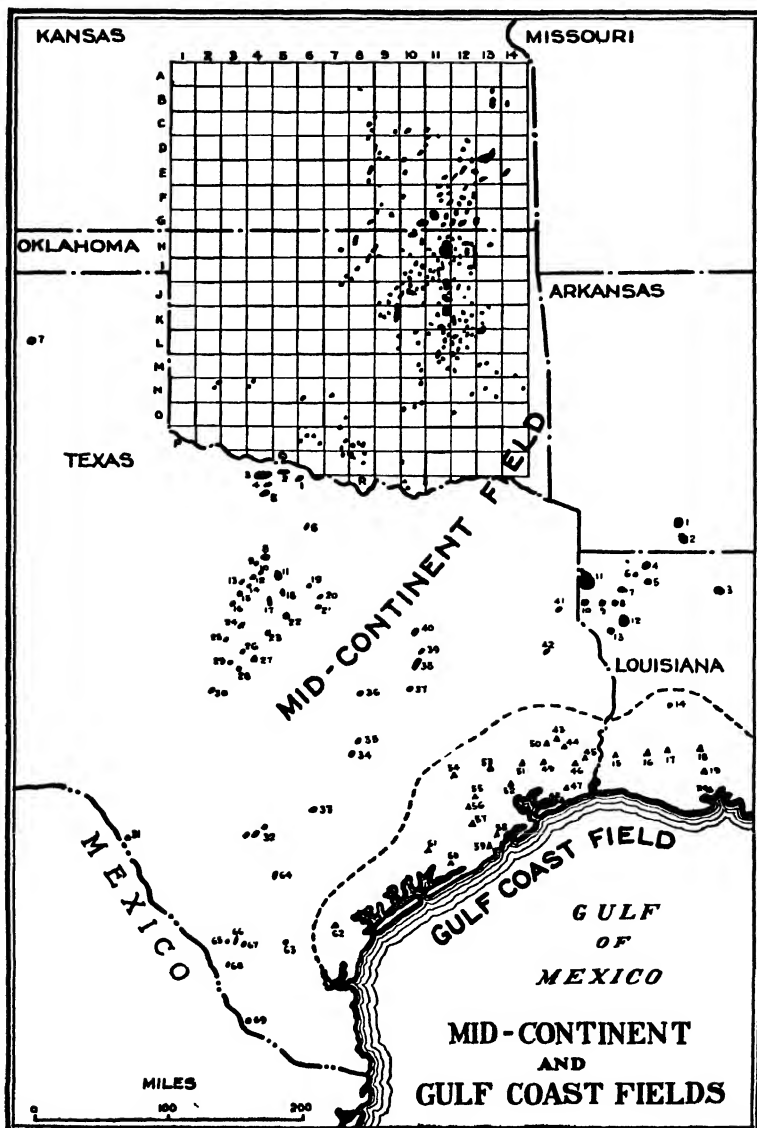
MID-CONTINENT DISTRICT

General Statement.—The Mid-Continent District includes the oil fields of Missouri, Kansas, Oklahoma, Arkansas, north and central Texas, and northern Louisiana.

In Kansas, Oklahoma, and northern Texas, petroleum is derived mainly from sandstone layers included in formations of the Pennsylvania series; in southern Oklahoma, sandstone layers in the "Red Beds" of the Permian series form the reservoirs of oil in the Healdton District; in northern Louisiana and central Texas, the oil is found in sandstones or other porous rocks belonging to the Cretaceous and Tertiary systems.

Oil and gas occur in anticlines, domes, half domes, terraces, and undulating monoclines on the flanks of the major uplifts, such as the Ozark, Wichita, Arbuckle, and Sabine. On the whole, the structural features are somewhat less accentuated than those in the Appalachian District. The oil saturation is greater than in most other fields, and structural elevations with less than 20 ft. of closure are diligently searched for and explored.

Development and Production.—Although a small production was obtained in Kansas in 1882, the development of the Mid-Continent District on a commercial scale may be said to have begun in 1900. Kansas was then the most important producing state in the district, but by 1904 the output of Oklahoma had surpassed that of Kansas. Among the most important fields may be noted the Glenn pool, discovered in 1906, and the Cushing, discovered in 1912. The first commercial discovery of oil in Texas was in Corsicana which was the only producer until 1900. In 1910, the Petrolia and Electra pools were discovered and, in 1912, the Burk-Burnett. The two most important fields in Louisiana are the Caddo, discovered in 1904, and the De Soto-Red River, developed in 1912 and 1914.



For names of oil fields see list on pages 232-236.

By far the largest production comes from Oklahoma, having reached over 100,000,000 barrels per year. Kansas, Texas, and Louisiana are next in importance. There are over 90,000 producing wells in this district and about 3000 in process of drilling.

The production of the Mid-Continent District is shown in the following table:

PRODUCTION OF PETROLEUM IN THE MID-CONTINENT DISTRICT

(in U. S. barrels)

1889	500	1906	22,839,911
1890	1,200	1907	46,896,267
1891	1,430	1908	48,823,747
1892	5,080	1909	50,833,740
1893	18,010	1910	59,217,582
1894	40,130	1911	66,595,477
1895	44,467	1912	65,473,323
1896	115,141	1913	84,920,225
1897	147,648	1914	97,994,900
1898	616,600	1915	123,294,317
1899	738,183	1916	136,934,439
1900	917,225	1917	163,506,205
1901	989,696	1918	179,383,098
1902	986,720	1919	196,891,000
1903	1,573,085	1920	249,074,000
1904	6,186,629	1921	256,085,000
1905	12,533,777	1922	305,789,000

The Mid-Continent crude varies within wide limits, as to gravity and composition. A typical oil has a gravity of 34° Bé. (0.854 sp. gr.) and contains about 22 per cent gasoline, 15 per cent kerosene, 12 per cent gas oil, and 29 per cent fuel oil.

Prospective Fields.—Owing to the great area covered by the various fields of this district, the lack of surface geological evidence in some of them on which to base definite predictions as to new productive fields, and the different geological and structural conditions under which the oil accumulates in the various districts, it is a very hazardous undertaking to predict the locations or extent of the prospective areas. However,

judging from past experience, it is logical to predict that there will be important productive areas discovered in the future. This new production may be the result of deeper drilling in the present productive fields, like the encountering of the Wilcox sand in Okfusee; or the proving of lands now considered wild-cat territory; or the westward extension of the producing fields of Oklahoma and Kansas, and the eastward extension of some of the Texas fields.

It is quite evident that the present productive fields in the Mid-Continent District do not define the extent of production, and that the important extension of them is a logical conclusion.

GULF COAST DISTRICT

General Statement.—The Gulf Coast District includes the oil fields on the Gulf Coast Plain of Texas and Louisiana. The pools are associated with salt domes, and those in southern Texas, not so related, are included in the Mid-Continent District.

Eastern Texas and Louisiana are underlain by Mesozoic and Cenozoic rocks which outcrop as broad belts in which the younger rocks lie successively nearer the sea and extend farther north in the region of the Mississippi River than east or west of it. At many places, low mounds or hills rise above the generally level plain; on some of these there are small lakes from which gas bubbles escape. Drilling has shown that cores of salt with petroliferous beds underlie many of the mounds or the localities where indications of petroleum are present. The origin of the structure of the salt domes is attributed to the force of crystallization of the salt, rising as brine along faults and fissures, solidifying, pushing up, and doming the surrounding plastic clays. The reservoir rock is generally either porous dolomitic limestone, or sandstone ranging in age from Cretaceous to Quaternary.

Structurally, the region has been characterized as a gently pitching trough with its axis lying along the Mississippi River. The beds, in general, dip at very low angles, though locally they are sharply faulted, and details of structure are derived princi-

pally from drill holes. There are many pools in which the dome-structure has been proved, and some where the principal structural features appear to be faults.

Development and Production.—The first commercial production in the Gulf Coast District came from the Spindletop well, drilled by Captain Lucas near Beaumont, Texas, in 1901. Since that date the Salt Dome District has produced close to 500,000,000 barrels of oil. The most important producing pools to date are Humble, with a total of 100,000,000 barrels; Sour Lake, with 60,000,000; and Spindletop and Jennings, with close to 50,000,000 each. About 70 well-defined salt domes are known in the Texas and Louisiana region, with approximately 3000 producing wells which average about 36 barrels each per day. About 500 wells are being drilled. Production of the Salt Dome pools is erratic, but characterized by large flowing wells. These pools bear a great geologic similarity to the Roumanian fields, which are likewise associated with salt cores which cause oil to accumulate at high pressure.

The production of the Gulf Coast District since 1901 is shown in the following table:

PRODUCTION OF PETROLEUM IN THE GULF COAST DISTRICT

(in U. S. barrels)

1901	3,593,113	1912 .	8,545,040
1902	18,014,404	1913 .	8,542,494
1903	18,371,383	1914 .	13,118,028
1904 .	24,631,269	1915 .	20,578,653
1905	36,526,323	1916..	21,768,096
1906 .	20,524,162	1917..	24,342,879
1907	16,360,299	1918 . .	24,207,620
1908..	15,772,137	1919 .	20,568,000
1909	10,883,240	1920	26,801,000
1910	9,680,465	1921	34,160,000
1911... .	10,999,873	1922....	35,368,000

The Gulf Coast oil has a gravity of about 21.7° Bé. (0.923 sp. gr.) and contains very little gasoline and kerosene, about 7 per

cent gas oil, 75 per cent lubricating oils, and 12½ per cent asphalt.

Prospective Fields.—It is estimated that there are excellent possibilities of extending the present producing fields by deeper drilling or by the discovery of new pools in the Salt Dome region.

ROCKY MOUNTAIN DISTRICT

General Statement.—The Rocky Mountain District includes the producing fields in the states of Wyoming, Colorado, and Montana; the production of the first one is the most important.

The petroleum in this district is obtained from rocks of Carboniferous and Cretaceous age; the Cretaceous is the most important producing formation in Wyoming. All the reservoir rocks are sandstones, with the exception of the limestone of the Embar.

The Rocky Mountain area is characterized by uniformity in the lithology of the formations involved and of the structure responsible for the accumulation of the petroleum. Many of the oil fields are developed in well-defined domes, the tops of which have been eroded to form basins, with the concave topography corresponding to the convex structure. Faults and other structural features modify the anticlines and domes in some localities, but quaquaversal structures and plunging anticlines are the most common.

Development and Production.—The greatest amount of oil produced in the Rocky Mountain District comes from the Salt Creek field of Wyoming which is, without doubt, one of the most important productive areas of the country. Many of the wells in this field are gushers, and the average production of 49 barrels per well per day for the 1500 wells in the entire district is the greatest of any in the United States. Great volumes of natural gas, which is utilized for the manufacture of gasoline and other purposes, accompany the oil in the Salt Creek fields.

The production of the Rocky Mountain District since 1890 is shown in the following table:

PRODUCTION OF PETROLEUM IN THE ROCKY MOUNTAIN DISTRICT

(in U. S. barrels)

1890	386,842	1907	341,190
1891	665,482	1908	397,428
1892	824,000	1909	330,917
1893	594,390	1910	355,224
1894	518,115	1911	413,621
1895	441,687	1912	1,778,358
1896	364,328	1913	2,595,321
1897	388,584	1914	3,783,148
1898	449,858	1915	4,454,000
1899	395,838	1916	6,476,289
1900	322,835	1917	9,199,310
1901	465,920	1918	12,808,896
1902	403,154	1919	13,584,000
1903	492,885	1920	17,517,000
1904	513,305	1921	20,765,000
1905	384,692	1922	28,698,000
1906	334,582		

The oil produced by the older strata ranges in gravity from 18° to 24° Bé. (0.945 to 0.909 sp. gr.) and is of asphalt base; that from the Cretaceous ranges from 33° to 48° Bé. (0.585 to 0.786 sp. gr.), is of paraffin base, and is very well suited for refining. The Salt Creek crude has a gravity of 36.5° Bé. (0.841 sp. gr.) and contains 29 per cent gasoline, 15 per cent kerosene, 10 per cent gas oil, and 17 per cent lubricating oils.

Prospective Fields.—Recent development in Montana has proven the existence of commercial quantities of oil to the north of the Wyoming fields; and this, coupled with the great potentialities of the Wyoming fields, points to the belief that the present production from the district is materially less than its possibilities. Future development and the connection of these fields by pipe line with the main pipe-line system will materially increase the production of the district as well as the number and area of the producing pools. There are a number of prospective areas in the adjoining states of Utah and New Mexico.

Extensive deposits of oil shale, which have not yet been exploited on a commercial scale, are located in the states of

Utah, Wyoming, Montana, and in other regions in the Rocky Mountain District.

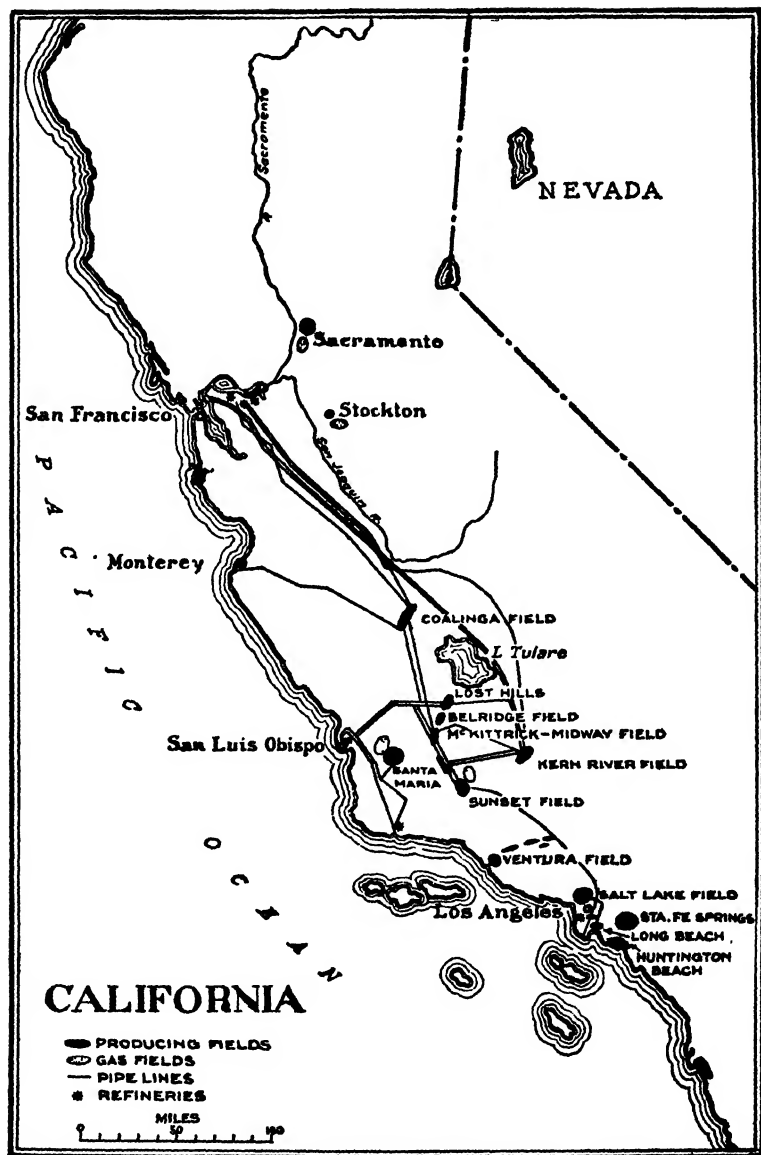
CALIFORNIA DISTRICT

General Statement.—All the commercially productive oil fields in California are located in the southern half of the state, on the eastern and western flanks of the Coast Ranges. The most important fields lie along the southern rim of the San Joaquin Valley and extend, with intervening unproductive areas, for about 100 miles. The Valley fields include Coalinga, Lost Hills, Kitt-rick, Mid-Way, Sunset, and Kern River. On the western flank of the Coast Ranges are located the Coast fields, which extend interruptedly for a distance of about 150 miles.

The oil industry in California owes its origin to asphalt mining. The first productive oil wells were drilled in the Ojai Valley in 1867, but it was not until the discovery of the Los Angeles and Summerland fields in 1894 that the commercial production of fuel oil began. The year 1900 marked the beginning of the importance of California as a world factor in the industry.

Commercial quantities of petroleum occur in every important geologic horizon from the Upper Cretaceous to the Pliocene, but the commercial accumulation is confined chiefly to the Miocene. Practically all the wells secure their oil from unconsolidated marine sands and sandstones; in rare instances, notably in the Santa Maria District, some oil comes from fractured hard shales. The cap rock formation, immediately overlying the oil reservoirs in practically every field, consists of hard blue or brown shale or clay. The origin of the California oil is believed to be largely in organic shales, locally known as diatomaceous Monterey shales.

The oil occurs in practically every form of geologic structure at one place or another in the fields; when it is remembered that the Coast Ranges afford some of the most involved folds and faults, complicated by igneous intrusions, the significance of this statement is apparent.



Development and Production.—California has for many years ranked first or second in the United States as a producer of petroleum; the total yield of the state averages close to 100,000,000 barrels per year. The individual well production ranges from the large gusher with a flow of 60,000 barrels per day to the small pumping well yielding a few barrels. The average production for each well is close to 30 barrels per day, which is exceeded only by the newer Rocky Mountain fields of Wyoming. There are at present about 6000 producing wells, ranging in depth from a few hundred feet to 4500 ft. Of late, the new fields near Los Angeles have greatly increased the production, necessitating the closing of some of the Valley properties.

The California District produces great volumes of natural gas; some of the Valley fields supply Los Angeles and the surrounding region with all the gas needed for industrial and domestic purposes. In many of the Coast fields, gas plants, where gasoline is made from natural gas, are in successful operation.

The production of the California District since 1890 is shown in the following table:

PRODUCTION OF PETROLEUM IN THE CALIFORNIA DISTRICT
(in U. S. barrels)

1890	307,360	1907	39,748,375
1891 .	323,600	1908	44,854,737
1892	385,049	1909	55,471,601
1893 ..	470,179	1910	73,010,560
1894 .	705,969	1911	81,134,391
1895 ..	1,208,482	1912	87,272,593
1896 .	1,252,777	1913 .	97,788,525
1897 .	1,903,411	1914	99,775,327
1898 .	2,257,207	1915 .	86,591,535
1899 ..	2,642,095	1916 .	90,951,936
1900. . .	4,324,484	1917. . .	93,877,549
1901 ..	8,786,330	1918 . .	97,531,997
1902 . . .	13,984,268	1919 ..	101,564,000
1903. . . .	24,382,472	1920 ...	105,668,000
1904	29,649,434	1921. . . .	114,709,000
1905 ..	33,427,473	1922. . . .	139,671,000
1906. . . .	33,098,598		

The California crudes, with the exception of a negligible quantity carrying paraffin, are of asphalt base, and the bulk of the production, as a residuum after refining, is used for fuel. Of late, however, owing to the discovery of lighter oil in great quantities, more of the total production goes through some process of topping or refining. The oil ranges in gravity from 14° Bé. to 40° Bé. (0.972 to 0.823 sp. gr.). A typical California crude contains 22 per cent gasoline, 19 per cent kerosene, 18 per cent lubricating oils, and 21 per cent residuum.

Prospective Fields.—Although it has been repeatedly stated by competent geologists that the producing area of the state is well defined, the result of the development in the last few years clearly demonstrates the great potentialities of the California oil fields, not only in the drilling of deeper wells and in the extension of the present proven areas, but in the discovery of entirely new pools as has been the case with those near Los Angeles. It is therefore safe to assume that California will rank as one of the important producing states and one of the richest oil regions in the world for years to come.

PETROLEUM LEGISLATION

Private Lands.—The petroleum legislation in the United States has, as its basis, the principle that the ownership of the surface includes the ownership of the subsoil, whether the lands be owned by individuals or by the state. Privately owned lands may be explored and exploited by the owner, or may be leased or sold for development. The relation between the owner and the lessee, and between them and the state, is within the scope of the private law and is regulated accordingly. The subsoil may be disposed of independently of the soil, and vice versa. The lessee is not the owner of the oil until it is reduced to possession. Exploration and development, rent or royalty are the controlling considerations.

Public Lands.—The regulations covering public lands are embodied in the Oil Leasing Act, approved on the 5th of February,

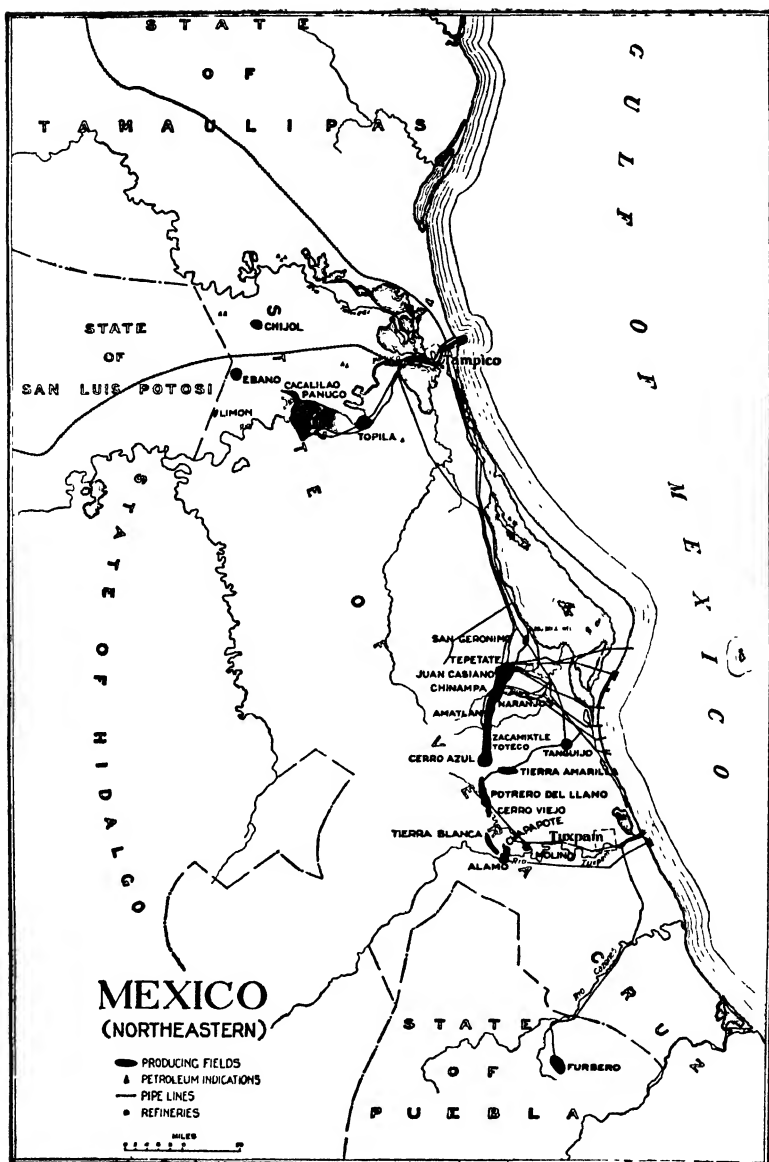
1920, by which exclusive rights to prospect are granted, by the Secretary of the Interior, to American companies or citizens, or to citizens of another country where American citizens enjoy the same rights. These permits extend for a period not exceeding two years, and cover an area of not more than 2560 acres if not within any known geologic structure of a producing field.

A preference right to a prospective permit is given to any person who was, on the 1st of October, 1919, a bona fide possessor of the land. Such permits provide that operations shall commence within six months, that drilling to an aggregate depth of not less than 2000 ft. be done within two years, and that a royalty of 20 per cent of the oil exploited in the exploitation period be paid to the Government.

Upon discovery of valuable deposits of petroleum, the Secretary of the Interior will grant a twenty-year lease for one-fourth of the land covered by the permit, upon a yearly rental of \$1 per acre and a royalty of 5 per cent of the oil obtained. A lease on the remaining 75 per cent of the land will be offered in preference to the owner of the permit, on the same terms as the highest bidder, upon payment of a royalty of no less than $12\frac{1}{2}$ per cent of the oil obtained, plus varying amounts payable as bonus.

Unappropriated deposits of oil, situated within a known geologic structure of a producing field, are leased to the highest bidder.

The exploration and exploitation of oil lands, which are the property of individual states, are subject to regulations more or less similar to those of the Oil Leasing Act.



MEXICO

INTRODUCTION

The Republic of Mexico has an area of about 767,000 square miles and a population of 15,800,000, with a density of 20 per square mile. Its geographic position, adjoining the United States, and its location on the Atlantic and Pacific Seaboards gives it unusual advantages over other Spanish-American countries. The greater part of Mexico is a vast plateau with an elevation between 4000 and 8000 ft., enjoying a temperate climate. Outside of the high plateau, the climate and vegetation range from the tropical of the lowlands to the perpetual snows of the high mountain peaks. Transportation and communication facilities include 16,000 miles of railroad and 115,000 miles of telegraph and telephone lines.

In 1810 the country declared its independence of Spain, but it was not until 1821 that the Republic was established. The President is elected for a term of four years and, according to the Constitution of 1917, cannot be re-elected. The National Debt is estimated at \$282,000,000, or \$17.85 per capita.

Mexico is one of the richest mining countries in the world, ranking first in the production of silver and second in that of petroleum. Its agriculture and cattle-raising industries are also important; the country leads in the production of sisal fiber for the manufacture of cordage. The chief exports, in order of their importance, are petroleum, vegetable products, and precious metals; the chief imports are metal products, foodstuffs, and textiles. The United States purchases 90 per cent of the exports and furnishes 70 per cent of the imports,

PETROLEUM RESOURCES

General Statement.—Although a small production of liquid asphalt was obtained at Ebano, west of Tampico, as early as 1901, and the product utilized locally, it was not until the famous Dos Bocas gusher came in, on the 4th of July, 1908, that the producing history of the Mexican oil fields may be said to have begun. In fact, it was nearly three years later before oil was first exported.

There are at present three producing regions, the Panuco District, about 30 miles southwest of Tampico; the Dos Bocas-Alamo District, which extends for 40 miles from Dos Bocas on the Tamiahua Lagoon south of Tampico to Alamo on the Tuxpam River; and the Tehuantepec District, which lies in the Isthmus of Tehuantepec in southern Mexico.

The development of the Mexican fields from 1910 to 1919 was marked by a series of sensational discoveries of new pools and by the persistently high yield of the old ones, with the result that the production of the country increased from 3,600,000 barrels in 1910 to 87,000,000 in 1919. The year 1919 marks the first appearance of salt water in the famous "golden lane," but the new discoveries more than made up for the decline, with the result that the production of 1920 doubled that of 1919. This high production was maintained for three years; but by the middle of 1922, discoveries were unimportant in comparison to the sharp decline of the old pools ruined by the invasion of salt water. By the end of 1922, the Dos Bocas-Alamo District and the old Panuco pools were totally or partially flooded.

The ready accessibility of the Mexican fields to the largest oil markets of the world, the remarkably high yield of the wells all of which produced from beginning to end by natural flow, the favorable though unsettled petroleum legislation, and the very low Government taxation, all combined to produce favorable conditions without a parallel; yet it is contended that the fields, taken as a whole, have been a commercial failure, notwithstanding the many unusual conditions favorable to commercial success. Many factors brought about this result; chief of which were

the high productivity of the wells, resulting in concentrated overproduction and low oil prices; the encouragement of drilling of wells by "wild-catters" who were in the oil business only during the life of the well and were anxious to sell the product at any price that would insure quick profit; the lack of foresight or of accurate technical information shown by many of the large operating companies, in planning their transportation, refining, and storage facilities without due regard to the probable economic life of the needed supply; and the unsettled internal conditions of the country, which made it impossible for the Government to carry through an intelligently mapped-out policy to properly control the exploitation and conservation of its oil resources. The decline of the Dos Bocas-Alamo and Panuco Districts does not mean the definite decline of Mexican production; it only marks the passing of the boom and waste days, to be followed by the carefully planned and conducted development of the very extensive and important unexploited oil regions of Mexico.

The production of the Mexican fields is shown in the following table:

PRODUCTION OF PETROLEUM IN MEXICO

(in U. S. barrels)

1901 .	10,345	1912 .	16,558,215
1902 .	40,200	1913..	25,696,291
1903 .	75,375	1914	26,235,403
1904	125,625	1915	32,910,508
1905	251,250	1916 .	39,817,402
1906 .	502,500	1917 .	55,292,770
1907	1,005,000	1918..	63,828,327
1908.	3,932,900	1919	87,072,954
1909.	2,713,500	1920 .	163,540,000
1910	3,634,080	1921..	193,397,587
1911.....	12,552,798	1922	185,057,000

PANUCO DISTRICT

The town of Panuco, 25 miles southwest of Tampico, marks the center of the District, which includes the Panuco, Topila and

Ebano fields. The region is readily accessible from Tampico, by railroad and by way of the Panuco River which is navigable for many miles. The formations involved in the geology of the Panuco District are of older Tertiary and Cretaceous age; the structure of the oil-bearing rocks is obscure, with an irregular terrace or several low anticlines modified by faulting.

The first wells were drilled near Ebano in 1901, but important commercial development did not start until nine years later. Salt-water invasion has since greatly affected the production, but it has been possible to greatly extend the life of the Panuco wells by controlling the flow. The recent discovery of the Cacalilao extension of this field has greatly increased the Panuco production. The drilling methods used in the Panuco District are a combination of the standard and rotary. The rotary usually drills to 1000 or 1600 feet, at which depth the casing is cemented, and then the standard drill continues to production in an "open hole" without casing.

The Panuco crude has a gravity of 12.2° B. (0.984 sp. gr.) and contains 2 per cent gasoline, 4 per cent kerosene, 14 per cent gas oil, 12 per cent lubricating oils, and 66 per cent asphalt; it is used for fuel oil, although small amounts are sometimes mixed with high-grade oils for refining purposes.

Three trunk pipe lines connect Panuco with the sea loading terminals at Tampico but, owing to the heavy gravity and high viscosity of the oil, the operation of these lines is at times unsatisfactory. The oil is also run from the gathering station to the Panuco River and is barged to the Tampico terminals.

DOS BOCAS-ALAMO DISTRICT

The Dos Bocas-Alamo District, locally known as the "Knife Edge," or "Southern Fields," is a narrow belt, less than 1 mile wide, extending for 40 miles from Dos Bocas on the Tamiahua Lagoon to Alamo on the Tuxpam River. It includes thirteen pools, the most important of which are Tepetate, Chinampa-Naranjos, Amatlan, Cerro Azul, Toteco, Potrero del Llano, and

Alamo. There are several other important pools in the same general region. The oil is found near the crest of a sharp fault or fold, in cavernous, fractured limestone of Cretaceous age, overlain by baked shales rendered porous by the effect of igneous intrusion. Basalt dikes follow the line of the main structure, some running parallel and many crossing the great fault at right angles. Surface indications of oil are numerous along the fault; the seepages are usually associated with basaltic intrusions.

At present, the Knife Edge pools are all totally or partially flooded with salt water, and, unless an entirely new region is discovered in the immediate future, the production of the light oil will continue to rapidly decline. The magnitude and number of the flowing wells of the Knife Edge pools have been the distinctive features of Mexican oil development. For several years, three wells produced 10,000,000 barrels each per year; their aggregate yield alone outranked the total production of every country outside of the United States and Russia.

The most important events in the history of the Dos Bocas-Alamo District, after the Dos Bocas well caught fire, in July, 1908, were the discovery of the Casiano and Potrero fields, in 1910, which established Mexico as a leader in oil production; the discovery of the Alamo field in 1917; of the Tepetate and Naranjos fields in 1918; the flooding of Casiano, Tepetate and Potrero in 1919, and of Chinampa in 1920; the discovery of the Zacamixtle field and the flooding of Naranjos in 1921; and the flooding of the Toteco-Cerro Azul field and the consequent sharp decline in light-oil production in 1922.

Natural gas in great volumes accompanies the oil and is partly utilized as fuel. During the flush production of the fields, the greater part of the gas was allowed to burn without being utilized.

The Dos Bocas-Alamo crude has a gravity of 20.5° Bé. (0.933 sp. gr.) and contains 8 per cent gasoline, 9 per cent kerosene, 3 per cent gas oil, 74 per cent fuel oil, and 1 per cent paraffin.

A large percentage of the crude is run through topping plants, which produce crude gasoline and fuel oils. From the gathering stations in the fields, the oil is transported in 27 trunk pipe lines to

the terminals at Port Lobos, Tampico, and Tuxpam with an aggregate daily capacity close to 800,000 barrels. The oil at Port Lobos and Tuxpam is loaded on the tankers by means of submarine lines extending about a mile off shore, and at Tampico the oil is loaded directly into tankers. Five large refineries are located at Tampico, and the majority of the Lobos terminals are equipped with topping plants.

TEHUANTEPEC DISTRICT

One of the oldest districts is situated in the southern part of Mexico in the Tehuantepec Isthmus, where production was obtained as early as 1902. The fields yield small volumes of high-grade oil, but have not, at any time, been an important factor in the production of the country. The first important discovery was made near Soledad in 1909, and later two other fields were opened, but development was not pushed forward, owing to the advantages of the more prolific fields near Tampico. Although high initial flows have been encountered, the production of the wells has always been uncertain and small, because of the large volumes of sand that accompany the oil. The oil, which is of higher grade than that of the other fields, occurs principally around salt domes, the producing formations of which are of Tertiary age.

• It has a gravity of 32.5° Bé. (0.86 sp. gr.) and contains 20 per cent gasoline, 25 per cent kerosene, 20 per cent light distillates, 20 per cent lubricating oils, and 15 per cent residuum.

English interests erected a refinery at Minatitlan, and another smaller plant is located at the port of Vera Cruz; but during the past few years both of these refineries have handled mostly Southern Field crudes.

MISCELLANEOUS PROSPECTIVE FIELDS

Oil indications are prominent to the south, west and north of the present producing fields, in the states of Chiapas and Oaxaca, and along the western coast in Lower California. Less promising

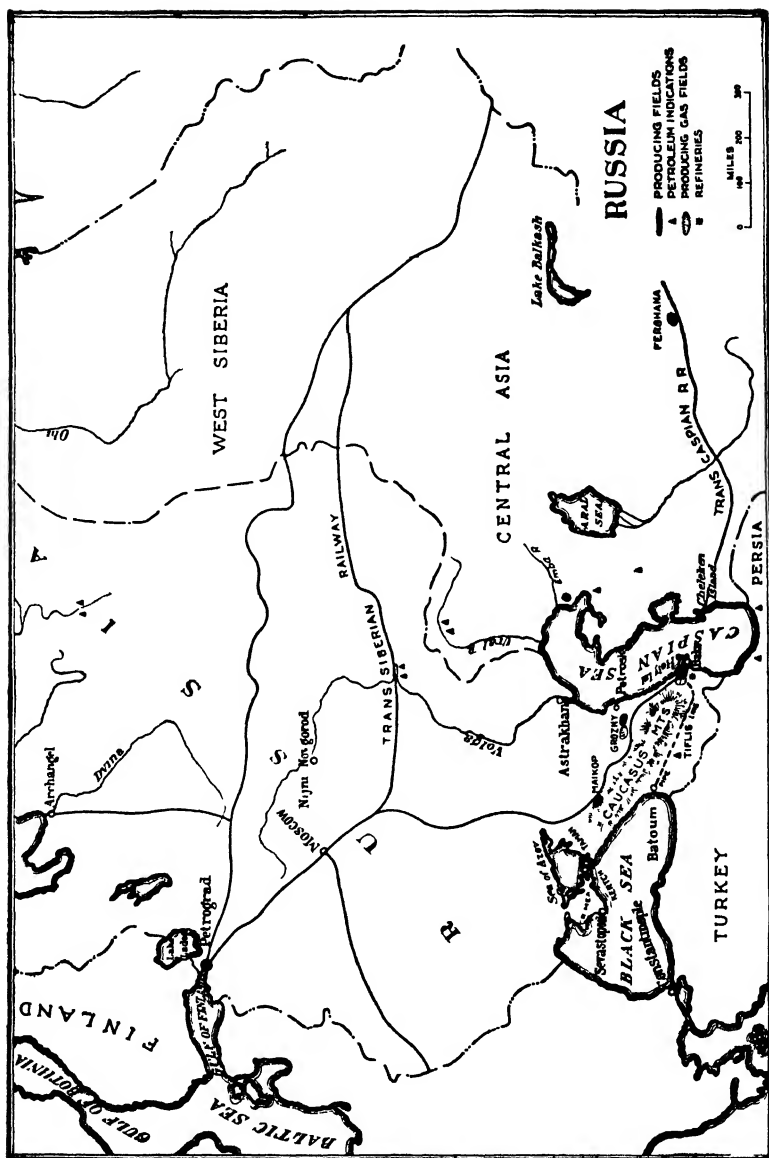
indications exist in the states of Chihuahua and Coahuila, and along the boundary between Mexico and the United States.

PETROLEUM LEGISLATION

By the Constitution of 1917, the ownership of the subsoil is vested in the State. The Government will issue titles, after denouncement, which grant the legal possession of the subsoil, but not its ownership. All the proposed Mexican petroleum laws and decrees are based on Article 27 of the Constitution.

Denouncements can be made on public lands, but Government titles will only be issued to natives, or companies organized under the laws of Mexico. A rental of \$1 per acre, and a royalty based on the price of the oil, must be paid to the Government. On private lands, the owner has the preferential right of denouncement, which he may transfer.

As the greater part of the petroleum lands were privately owned, and many had been leased as oil lands prior to the enactment of the Constitution of 1917, owners and operators have been endeavoring to reconcile their interests with those of the Government in a final draft of interpretation of Article 27 which will eliminate the possibility of its being interpreted in a retro-active manner.



RUSSIA

INTRODUCTION

The Russian Socialist Federal Soviet Republic and its federated states include Siberia, the Far Eastern Republic, the Trans-Caucasian Republics, Khiva, Bokhara, the labor communes of the Black Sea and North Caucasus regions, and the northern portion of Sakhalin Island, north of Japan. It has an area of 8,166,000 square miles and a population of 131,000,000, with a density of 16 per square mile. Ten different languages are spoken, but Russian is the predominant tongue. Transportation and communication facilities include 46,000 miles of railroad, 42,000 miles of navigable rivers and canals, and 90,000 miles of telegraph line, all owned and operated by the State.

Russia was organized as a Republic in 1918, under a Constitution which establishes the Soviet or Communal Council of Laborers as the basis of popular participation in the Government. Executive and administrative functions are vested in the Council of People's Commissaries. This commission and its president are elected for one year, can be re-elected, and are subject to removal by the central Executive Committee of the All-Russian Soviet Congress. At the present rate of exchange, it is difficult to arrive at any accurate statement of Government finances. The National Debt, estimated at \$22,774,000,000 in 1917, was repudiated by the Soviet Government by a decree adopted in 1918.

After a lapse of three years Russia resumed foreign trade in 1920, exporting lumber, flax, and paper; and importing woollens, cotton, and coal; the bulk of this trade was with Great Britain. There appears to be a trend toward improvement in commercial and Government activities throughout the country.

PETROLEUM RESOURCES

General Statement.—The Russian petroleum industry had its inception while the Baku fields were yet a Persian dependency,

and in 1806, when the region was annexed to Russia, commercial production was obtained from hundreds of hand-dug wells.

The districts at present producing in commercial quantities, in order of their importance, are Baku, along the southwestern shores of the Caspian Sea at the southeastern end of the Caucasus Mountains; Grozny, along the northern flanks of the Caucasus and about 280 miles northwest of Baku; Emba, on the northeast shores of the Caspian between the Emba, Sagis, and Nil Rivers; Maikop, on the northern flanks of the Caucasus, about 300 miles west of Grozny; Tcheleken Island, about 170 miles east of Baku, near the eastern coast of the Caspian; and Ferghana, in Turkestan, about 800 miles east of Baku.

For many years, the Russian fields were second in importance only to those of the United States, and under stable economic conditions the yield of the producing fields could easily be increased; it is estimated that the potentialities of Russia's prospective fields equal those of any other country.

The production of the Russian fields since 1890 is shown in the following table:

PRODUCTION OF PETROLEUM IN RUSSIA

(in U. S. barrels)

1890	28,691,218	1907	61,850,734
1891	34,573,181	1908	62,186,447
1892	35,774,504	1909	65,970,350
1893	40,456,519	1910	70,336,574
1894	36,375,428	1911	66,183,691
1895	46,140,174	1912	68,019,208
1896	47,220,633	1913	62,834,356
1897	54,399,568	1914	67,020,522
1898	61,609,357	1915	68,548,062
1899	65,954,968	1916	72,801,110
1900	75,779,417	1917	69,960,000
1901	85,168,556	1918	40,456,182
1902	80,540,044	1919	34,284,000
1903	75,591,256	1920	25,429,600
1904	78,536,655	1921	29,150,000
1905	54,960,270	1922	30,000,000 (estimated)
1906	58,897,311		

BAKU DISTRICT

General Statement.—The Baku District is located on the Apscheron Peninsula, at the eastern end of the Caucasus Mountains, and in the neighboring Sviatoi or Holy Island, and includes the Balakhani, Sabuntchi, Romani, Zabrati, Binagadi, Surakhani, Bibi-Eibat, and Sviatoi Island fields. The fields will be discussed as a unit, as they are in close proximity to one another and their aggregate area is only about 12 square miles.

The formations involved in the geology of the Baku District are unconsolidated clays and sands of Tertiary age; the Oligocene outcrops over a considerable portion of the area and is covered in places by Pliocene and later deposits. The oil reservoirs are of Miocene age, although some of the deeper wells obtain the oil from the Oligocene. The reservoir rocks are generally loose sands, which sometimes form 25 to 30 per cent of the volume discharged. Productive wells also obtain their yield from more compact sands and sandstones. The geologic structure controlling the accumulation of petroleum in the Baku District is an undulating anticline or partial dome, locally modified by faulting and cross folding. This complex condition is the result of the flexures along the northern and southern flanks of the Caucasus Mountains, which converge in the Apscheron Peninsula.

Development and Production.—The first productive wells were hand-dug, and this method is used successfully at the present time for wells up to 700 ft. in depth. In order to drill deeper and to cope with the unconsolidated formations, a modification of the Canadian drilling system, employing solid rods, has been developed. Riveted stove-pipe is employed, and depths of 2000 ft. are often reached with 14-in. casings; these large-diameter wells have the advantage of permitting the use of large bailers during their productive life. A period of one to three years is spent in drilling a deep well.

The oil from hand-dug wells is recovered with winches, while bailers are used in the greater number of the machine-drilled wells. With a bailer, having a capacity of $7\frac{1}{2}$ barrels, 2000 barrels

a day have been lifted from 2000-ft. wells. Under proper conditions of submergence, air-lift pumping has been successfully employed in certain areas of the Baku District. Steam and gas engines and electric motors are employed in the field operations.

The great productivity of the Baku gushers is one of the salient features of the petroleum industry. The first flowing well came in in July, 1873, but it was not until September, 1883, that the Droojba gusher began flowing at the rate of 50,000 barrels a day. This was the first of the big fountain wells. One of the biggest Baku producers yielded an average daily output of 10,000 barrels during one year, and flush productions of over 100,000 barrels per day have been authentically reported from other gushers. Natural gas accompanies the oil in many wells and is utilized for domestic and power-generating purposes.

The production of the Baku District, since 1890, is shown in the following table:

PRODUCTION OF PETROLEUM IN THE BAKU DISTRICT

(in U. S. barrels)

1890	28,691,218	1907	57,143,097
1891	34,573,181	1908	55,936,880
1892	35,774,504	1909	59,123,650
1893	40,456,519	1910	61,039,149
1894	35,380,000	1911	54,526,633
1895	44,640,000	1912	56,806,723
1896	45,160,000	1913	48,563,985
1897	51,100,000	1914	49,489,418
1898	58,490,000	1915	51,757,419
1899	62,930,000	1916	55,810,564
1900	72,110,000	1917	49,560,000
1901	70,990,000	1918	24,009,604
1902	76,460,000	1919	20,210,000
1903	71,760,000	1920	16,200,000
1904	73,723,290	1921	17,500,000
1905	49,791,356	1922	19,000,000 (estimated)
1906	53,723,889		

Balakhani-Sabuntchi oil has a gravity of 30.3° Bé. (0.873 sp. gr.) and contains 6 per cent gasoline, 33 per cent kerosene, and 57

per cent lubricating oils. Surakhani oil has a gravity of 49.5° Bé. (0.78 sp. gr.) and contains 49 per cent gasoline and 44 per cent kerosene.

The Nobel brothers built the first refinery at Baku in 1875, and a little later the first pipe line, tank car, and tank steamer. The crude-oil output of the several fields of the Baku District is stored locally in sump holes or earthen reservoirs, from which it is piped to Black Town, the center of the 36 nationalized Baku refineries, where it is stored in steel tanks. The refined oil, mostly kerosene, is either delivered directly into tank steamers at the port of Baku, for transportation to the Volga River, or piped to Batoum on the Black Sea for storage and shipment.

GROZNY DISTRICT

General Statement.—The Grozny District is located on the northern flank of the Caucasus Mountains, about 280 miles northwest of Baku and 100 miles west of the port of Petrosk on the Caspian Sea. The district includes the Mamakai, Bellik, and Braguni fields, which lie in the upper basin of the Terek River, and the Bereker field, to the southeast near the Caspian coast. The producing area of the Grozny District covers about 6670 acres.

The characteristic formations of the district are Miocene shales, sandy clays, limestones, and dolomites; the oil occurs in the unconsolidated Chokrak, Miocene sands which are sealed by compact clays. The geologic structure of the district has been variously interpreted as a sharply faulted anticline or a partial dome with the largest accumulation on the flat limb of the fold.

Development and Production.—Hand-dug wells have been in operation in Grozny since 1823, but it was not until 1893 that the first flowing well was drilled. Standard and rotary drilling has been successfully employed, resulting in cheaper drilling costs than in Baku, where, owing to the unconsolidated nature of the sediments, it has not been found advantageous to employ American methods. The depth of productive wells in Grozny ranges from

500 to 3000 ft., with the deeper borings dating from 1910. Extended use of natural gas for fuel has greatly decreased the consumption of petroleum for field operations. The bulk of the production is from natural flow; bailing and the deep-well pumping method are resorted to after the flush period of production.

The production of the Grozny District is shown in the following table:

PRODUCTION OF PETROLEUM IN THE GROZNY DISTRICT
(in U. S. barrels)

1894	1,000,000	1909 .	6,846,700
1895	1,500,000	1910 .	8,889,359
1896	2,060,000	1911	9,026,361
1897	3,300,000	1912	7,851,140
1898	2,120,000	1913	8,842,649
1899	3,020,000	1914	11,818,150
1900	3,670,000	1915	10,583,320
1901	4,180,000	1916	12,332,683
1902	4,080,000	1917	14,760,000
1903	3,920,000	1918	13,205,283
1904	4,813,365	1919 .	9,235,000
1905	5,168,914	1920	7,650,000
1906	4,606,675	1921	8,200,000
1907	4,707,637	1922 .	9,000,000 (estimated)
1908 . . .	6,249,567		

Grozny oil has a gravity of 30° Bé. (0.875 sp. gr.) and contains 19 per cent gasoline, 16 per cent kerosene, 56 per cent lubricating oils, and 5 per cent paraffin.

The oil output of the Grozny district feeds eastward by pipe line to the Port of Petrosk, and thence by tankers into the interior markets, by way of the Caspian-Volga route which is open eight months of the year. To the west, outlet is by tank cars to the ports of Novorossiisk and Tuapse on the Black Sea, thence mainly to Odessa by water. Oil is stored on extensive tank farms located at Grozny and Novorossiisk on the Black Sea and at the mouth of the Volga River. Part of the crude oil is refined at Novorossiisk, whence the light oils are exported. The rest of the oil is refined

at Grozny, where there are five refineries, and piped to Petrosk for transshipment to Astrakan and the interior.

EMBA DISTRICT

General Statement.—The Emba District, which includes the Dos Sor, Macat, Karaton, Karatchural, and Novo-Bogatinsk fields, is located in the Province of Uralsk on the northeastern shores of the Caspian Sea, in the region drained by the Emba, Sagis, and Ural Rivers. It covers an estimated area of 60,000 square miles. Detailed geologic data are lacking for this region, but the information available shows that the surface formations are of Pleistocene age. Wells drilled to 750 ft. have shown a compact formation of salt, gypsum, and heavy sands which in the ordinary sediments are fairly consolidated.

Development and Production.—Drilling operations were begun in 1900, and in 1911 a flowing well was struck at 730 ft. in the Dos Sor field; by 1914 the yearly production of the Emba District had reached 2,002,000 bbls. The decrease of production in recent years is ascribed to interruptions, due to political disturbances. Ozokerite has been found in the Karaton field between 100 and 200 ft. in depth.

The production of the Emba District is shown in the following table:

PRODUCTION OF PETROLEUM IN THE EMBA DISTRICT

(in U. S. barrels)

1913.	862,184	1918.	1,680,672
1914	2,001,801	1919	1,364,200
1915.	1,996,639	1920	1,150,000
1916	1,824,730	1921	1,200,000
1917.	1,800,000	1922.	1,500,000 (estimated)

The Emba oils have a gravity of 16.6° to 34.7° B. (0.955 to 0.85 sp. gr.) and contain 2 per cent gasoline, 11 per cent kerosene, and 86 per cent lubricating oils.

There are two 6-inch pipe lines carrying oil from the Dos Sor field to the refineries and shipping port of Rakusha on the Caspian,

45 miles from the field. The main shipments are made by the Volga River route into interior Russia; smaller percentages reach the south of Russia by way of the Baku-Batoum pipe line, thence over the Black Sea route to Odessa. Winter conditions limit the use of the Volga outlet to eight months of the year. The Emba fields are nearer to the mouth of the Volga, and therefore to the Central Russian markets, than the Baku and the Grozny Districts.

MAIKOP DISTRICT

General Statement.—The Maikop District is located on the northern slope and at the western end of the Caucasus range in the Province of Kuban. It is 300 miles west of Grozny and 50 miles northeast of the Black Sea port of Tuapse. The developed area is small and locally highly productive. The district includes the Shirvansky and Kudako fields; the latter covers an area of 5000 acres.

The characteristic regional formation is of Miocene age; the oil occurs in beds of upper Oligocene in a series of dolomitic limestones, shales, marls, and sandy beds, about 1000 ft. in thickness. The two main oil zones outcrop at several places. The structure, which is anticlinal, is developed on gently folded Tertiary beds resting unconformably upon denuded Cretaceous rocks, dipping uniformly at low angles. The petroliferous strata are on the down dip and consist of a narrow strip of heavy sands extending northwest, parallel to the axis of the Caucasus.

Development and Production.—The Kudako field began production from shallow wells in 1866; but it was not until the pioneer gusher was struck in the Shirvansky field, in 1909, that Maikop became important. The Maikop District still yields about 250,000 barrels a year, although the original proven area has not been greatly extended. The depth of wells in the Maikop District ranges from 150 to 5000 ft. Portable Star rigs are used for shallow drilling, while on deep operations the free-fall and the Galician rigs are about equally favored. Deep-well pumping is employed over the entire district.

The production of the Maikop District is shown in the following table:

PRODUCTION OF PETROLEUM IN THE MAIKOP DISTRICT

(in U. S. barrels)

1910	.	156,640	1917...	960,000
1911	.	952,453	1918 ..	360,144
1912	.	1,104,442	1919	310,000
1913	..	576,507	1920	250,000
1914	..	475,019	1921.	275,000
1915	..	910,204	1922. . . .	300,000 (estimated)
1916	.....	240,096		

A wide range of quality is noted in the oils of this district. The Maikop crude has an average gravity of 32.8° Bé. (0.86 sp. gr.) and contains 13 per cent gasoline, 33 per cent kerosene, and 53 per cent lubricating oils.

An 8-in. pipe line, 70 miles long, connects the Maikop District with Ekaterinodar on the Kuban River, which gives an outlet to the Black Sea; and a 6-in. pipe connects it with Tuapse on the Black Sea, 75 miles to the northwest. The Amarri-Tuapse Railway taps this region. The aggregate capacity of steel tankage in Shirvanskaya and Apscheronkaya is estimated at about 400,000 barrels, and that of open reservoirs at 70,000 barrels; tanks at Ekaterinodar have a capacity of 150,000 barrels and those at Tuapse 75,000 barrels. Maikop refineries are located at Ekaterinodar on the Kuban River, which is a railroad center into southern Russia, about 50 miles from the Black Sea.

TCHELEKEN ISLAND DISTRICT

General Statement.—The Tcheleken Island District lies off the eastern coast of the Caspian Sea, almost directly opposite, or east of, Baku. The geologic formations of the Tcheleken field are closely allied to those in the Baku field, and this results in costly and lengthy drilling work. The island is a structural dome, much faulted, with its major axis turning in a northwest-southeast direction. The producing area is on the southwestern end of the

island, on an anticline developed in beds of middle Tertiary age.

Development and Production.—Tcheleken wells have been highly productive, having yielded over 8,000,000 barrels of oil. Tcheleken oil is in part of a paraffin base, and has sealed the faults by forming ozokerite in them. The oil is distinguished from that of Baku by its large content of tar acids. The bulk of the oil produced at Tcheleken is transported to the refineries at Baku by tankers.

FERGHANA DISTRICT

General Statement.—The Ferghana District is situated in the southeastern part of Turkestan, in the Syr-Darya Valley, just north of the Tiehshan Mountains and about 800 miles east of the Caspian Sea. It is reached from Tcheleken by the Transcaspian Railroad. The geologic formations include two oil horizons of Cretaceous and lower Tertiary series; the Cretaceous are folded into a complex anticlinal structure.

Development and Production.—The developed area lies in the southern part of the district, around Tchimion, and the highest production is obtained from borings of 550 to 1000 ft. in the Maili-Sai field. Deep wells have produced an oil similar to that of the Bibi-Eibat field, with a gravity of 54.2° Bé. (0.76 sp. gr.). Tchimion oils show a high paraffin percentage. Ozokerite is mined in the adjacent districts of Kanibach and Lyakan. Refineries are located at Tchimion. All of the oil produced, which totals about 240,000 barrels a year, is consumed locally by the Transcaspian Railroad and the cotton industry.

PROSPECTIVE FIELDS

Important oil indications are known to exist in many regions which have not yet passed the prospecting stage, or are only partially developed by crude surface workings.

The Transcaspian District occupies an area rich in petroleum indications, on the mainland east of the Caspian Sea. Naphtha Gora, or Naphtha Hill, lying about 100 miles inland from Krass-

novodsk, in the center of the district, is the only locality where development work is going on. The output of shallow wells at Naphtha Gora and Tageer has been consumed locally by the Transcaspian Railway since 1881. This region is also rich in ozokerite.

The Western Caucasus and Black Sea District includes the Kertch Peninsula and Taman Peninsula, southeast of the Crimean area; the region near Anapa on the shores of the Sea of Azov, where shallow drilling has shown promising results; the Province of Kutais, south and west of Anapa, especially in the Supsa section; the Province of Tiflis east of Kutais and south of the Caucasus Mountains, where small workings have been made; and the Province of Daghestan in the Durbend region. Small quantities of high-grade oil are obtained at Naftalan, south of Tiflis. This oil, known as "Naftalan," is used almost exclusively for its medicinal and healing qualities. Oil is also reported from the North Caucasus province of Stavropol; and in the upper Uralsk area of the North Caspian section there are indications of a second oil belt of the present working area.

The Samara and Saratoff provinces of the upper Volga Basin contain areas rich in petroleum and asphaltic tar.

In Northern Russia, at Archangel and Vologda, indications of petroleum occur in the Petchora River basin and in Devonian rocks on the shores of the Tcheleken Bay.

Western Siberia contains petroleum evidences in the Turgai Province and along the Djusie River near the Salt Lake of Alagul.

Eastern Siberia has indications of petroleum in Minusinsk, Lake Baikal and adjacent regions, Selegin District, Amur River, Sakhalin Island, and eastern Kamchatka.

PETROLEUM LEGISLATION

When Russia annexed the Baku region from Persia, in 1806, it granted an oil-production monopoly to a Mr. Mirsoeff, and this monopoly was not abolished until 1872. From that time on, prospecting permits were granted mainly to court favorites.

These grants covered, as a rule, 100 acres, of which 27 acres could be selected when oil was found. A yearly rental of \$2 per acre was paid during the first year, increasing ten times every ten years; these rentals were later abolished, and in their place a royalty of 25 per cent and upwards of the oil produced was collected. In the Cossack lands of the Terek-Kuban provinces, rentals were \$5 an acre yearly, and the royalty 4 cents a barrel.

With the passing of the Russian Empire, all the mining laws which had been codified in 1893 were repealed by the Soviet Government; and, under the military dictatorship established by the Revolution in October, 1917, all rights of private property were abolished by decree. This action was later confirmed by the Constitution of 1918, which declared the nationalization of commerce, industry, and agriculture, by forced expropriations without indemnity, and made foreign commerce a Government monopoly. In March, 1921, a new economic policy was adopted; the process of nationalization was restricted, and the Government concentrated its material and financial resources, retaining control of only the most important national enterprises. Minor private commercial and industrial enterprises were authorized and regulated, and in other cases State control was retained or supervision effected by mixed corporations in which the State retained a half interest.

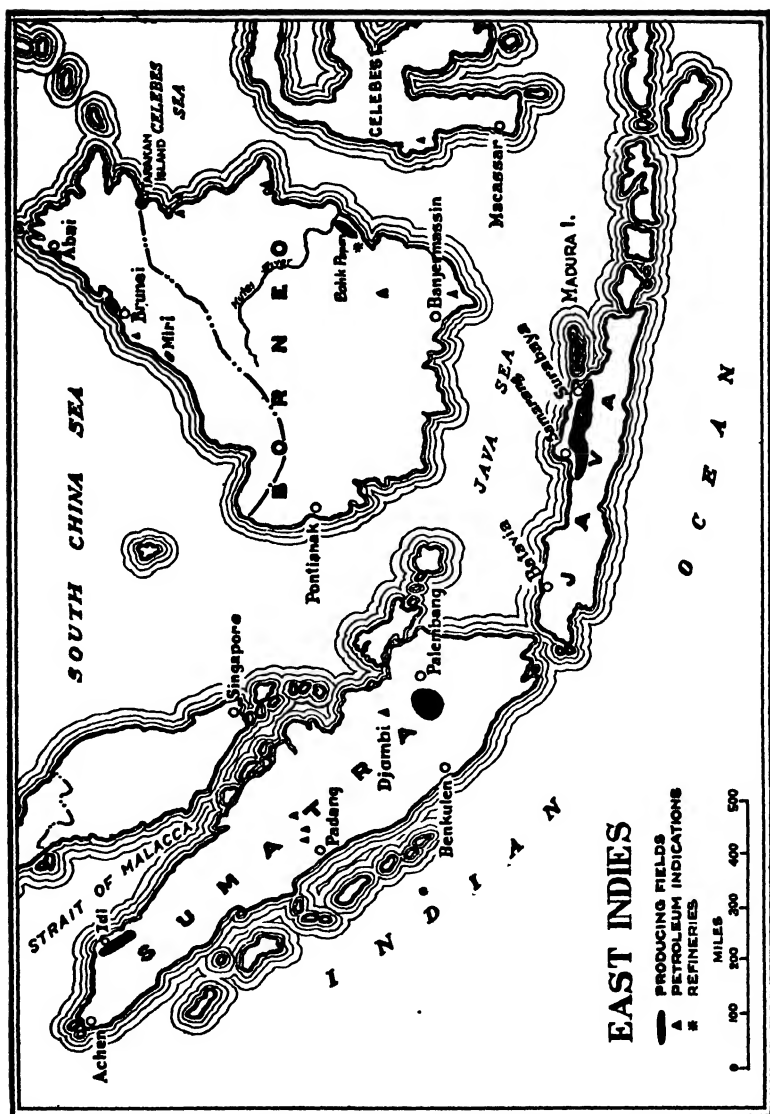
At present there are no mining or written civil laws in Russia, and decisions are based upon legal conscience and precedent. The property of a Russian citizen at death reverts to the State.

The State owns the surface and subsoil rights in all petroliferous regions. A Central Committee on Concessions, with authority to enter into agreements with foreign interests for the development of petroleum resources, has been created, following an unsuccessful attempt at Government operation of the fields.

The concessions to be granted by the committee are likely to provide for the State's retention of subsoil ownership and for its participation in the receipts of production on a royalty basis or by shares in the enterprise. Acceptance of incorporation papers and by-laws of concessionaires is understood not to be final

without the approval of the Council on National Economics. It is intimated that there will be freedom for foreign trade in oil, and that, in granting concessions, the Government will indemnify persons possessing justified previous claims on the lands.

It has been reported that concessions were granted to American interests for the operation of some of the Baku wells, as agents or contractors of the Government. A concession, covering 280,000 acres on the northern half of Sakhalin Island, has been granted to American interests. The Government is to receive a rental of 19 cents per acre and a royalty of 6.3 to 13.7 per cent, depending on the total production.



DUTCH EAST INDIES

INTRODUCTION

The Dutch East Indies include the islands of Sumatra and Java, the southern part of Borneo, and many smaller islands of the Malay Archipelago, with a total area of 683,000 square miles. Borneo is the largest island of the group. The population of the colony is estimated at 49,200,000, with a density of 72 per square mile. Java is the most densely populated, with 71 per cent of the total. The transportation and communication facilities include 4000 miles of railroad in the islands of Sumatra and Java, and 29,000 miles of telegraph and telephone lines, all owned and operated by the State.

The islands are a colonial dependency of Holland, and are administered by a Governor-General, appointed by the Home Government; there are two political subdivisions, Java and Madura, the outposts of which include the other islands. The Colonial Government budget for 1922 shows a deficit of \$56,000,000; the National Debt is estimated at \$149,000,000, or \$3 per capita.

Rice and maize are the principal agricultural products. Holland controls about 56 per cent of the foreign trade. The chief exports, in order of their importance, are sugar, coffee, and tea.

PETROLEUM RESOURCES

General Statement.—The Dutch East Indies became a factor in the oil industry in 1890, with the organization of the Royal Dutch Company, which undertook, as its first venture, to prospect for oil in northern Sumatra. Commercial production was encountered in 1892, and has steadily increased until at present there are commercial fields in Borneo, Sumatra, and Java, which rank fourth in the oil production of the world.

The percentage of production of each field is shown in the following table:

RELATIVE PRODUCTION OF FIELDS

	Per cent of total production
Dutch North Borneo	30 3
South Kutei.. . . .	31 4
<hr/>	
Borneo	61 7
North Sumatra	8 2
North Palembang... . .	5 8
South Palembang	8 6
<hr/>	
Sumatra	22 6
Samarang.... .	2 5
Rembang	10 9
Surabaya	1 5
<hr/>	
Java	14 9
Ceraman Island	8
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	100 00

The production of the Dutch East Indies is shown in the following table:

PRODUCTION OF PETROLEUM IN THE DUTCH EAST INDIES
(in U. S. barrels)

1893	600,000	1908	10,283,357
1894	688,170	1909	11,041,852
1895	1,215,757	1910	11,030,620
1896	1,427,132	1911	12,172,294
1897	3,551,649	1912	10,845,624
1898	2,964,035	1913	11,172,294
1899	1,795,961	1914	11,524,802
1900	2,253,355	1915	12,001,800
1901	4,013,710	1916	12,549,399
1902	2,430,465	1917	12,398,955
1903	5,770,056	1918	12,789,936
1904	6,508,485	1919	15,190,000
1905	7,849,896	1920	17,529,210
1906	8,180,657	1921	16,150,000
1907	9,982,597	1922	19,000,000 (estimated)

BORNEO

Producing Fields.—The producing oil fields of southern, or Dutch, Borneo lie along the east coast, in a belt 6 to 8 miles wide, extending from the Kutei River south to Balik Papan Bay. The geologic formation of this region consists of upper Tertiary sediments overlying the crystalline and eruptive rocks which form the backbone of the island. The controlling structural feature of the Kutei District is a long anticline, with undulating crest, which forms domes and saddles.

This district has a probable oil area estimated at 500 square miles, of which only the region near Balik Papan Bay has been developed. Drilling began about 1895, but commercial production was not encountered until 1898. Shallow wells, tapping the upper strata, yield heavy oil of an asphalt base, while deep wells, up to 1200 ft., produced lighter oil of a paraffin base.

The Kutei crude has a gravity of 33° Bé. (0.859 sp. gr.) and contains 17 per cent gasoline, 44 per cent kerosene, 33 per cent lubricating oils, and 6 per cent paraffin.

The crude is transported to Balik Papan Bay for refining and storage; the operations are controlled by British-Dutch interests.

Prospective Fields.—The prospective fields include the probable extensions of the present field, south to the region about Banjermassin, north to Tarakan Island, and the Sang Kulivan Bay region.

SUMATRA

Producing Fields.—There are two main producing regions in Sumatra: the northeastern district between Idi and the Lapan River, including the fields of Lapan, Beritag, Aru Bay, and Bukit Mass; and the south central, or Palembang, District, including the fields of Perlak, Palembang, Liaman, Luliul, Lalang, Kampang, and Babat. The geologic formation involved in the

northern and southern oil regions consists of loose sandstones interbedded with shales and clays of Miocene and Pliocene age. Three groups of brown-coal seams are characteristic of the middle Pliocene division. The petroleum is especially concentrated in sandstones at the base of these strata, which are in turn overlain by tuffaceous sediments from 3000 to 5000 ft. thick. Steep anticlines are the predominating structure of the producing areas.

The development of the oil resources of Sumatra was begun in 1890, by the Royal Dutch Company, operating in the north-eastern district; seven years later the Palembang region was discovered and has since yielded the largest production. The depth of wells ranges from 500 to 800 ft. in the northwestern region to 2400 ft. in the Palembang District. American and Canadian drilling methods are successfully employed in these fields.

The Sumatra crude has a gravity of 38° to 48° Bé. (0.833 to 0.789 sp. gr.) and contains 20 to 26 per cent gasoline, 47 to 63 per cent kerosene, and 7 to 31 per cent lubricating oils.

The crude of the northeastern fields is piped to the refinery of the Royal Dutch Company at Aru Bay, and from this point it is shipped to the nearby storage stations on Sembilan Island; the Palembang oil is transported by pipe line to the Lulang River, Palembang, and Gebang refineries. The refined products are marketed principally in the island and in Asia, while a small part finds its way to European markets. Production, refining, and marketing are under British-Dutch control.

Prospective Fields.—The prospective oil regions of Sumatra include extensions of the present producing districts and several other areas which up to the present time have not been tested. The important Royal Dutch Company concession, in the Djambi region north of Palembang has of late been receiving considerable publicity.

JAVA

Producing Fields.—The producing districts of Java are located on the northern side of the island, between Samarang in Java

and Madura Island. The Surabaya, or eastern, district, including the Kutei and Lidah fields, leads in production; while the Rembang District to the west, including the Tinawun and Panolan fields, is second in importance. The greater part of the island is covered with Tertiary clays, sands, and marls, frequently overlain by ash beds; volcanic activity is manifested at points. The oil occurs in the Miocene sands along well-defined anticlinal folds.

The wells are drilled by the water-flush system, and range in depth from 500 to 800 ft.; the average well production is small, but the yield is constant. Natural gas from the oil wells is utilized as fuel in the fields.

The oil from the Java fields has a gravity of 32.4° Bé. (0.862 sp. gr.) and contains 51 per cent kerosene, 42 per cent lubricating oils, and 7 per cent paraffin.

The output of the Kutei and Lidah fields is transported to the refineries at Surabaya and Samarang, while the Tinawun and Panolan crude goes to Rembang for refining and export. These refineries are owned and operated by the Royal Dutch interests and produce chiefly kerosene, lubricating oils, paraffin, and oil-paraffin candles. The output of kerosene and paraffin candles is largely consumed in the Java market.

Prospective Fields.—Beside the unexploited areas in the regions now producing, prospective oil fields are located at Lidah in Bartam and on Madura Island. These regions are associated with volcanic activity, which renders the estimates of the value of these lands uncertain without actual borings. There are also indications of oil on the southern coast of Java.

MISCELLANEOUS PROSPECTIVE FIELDS

Beside the prospective areas in Borneo, Sumatra, and Java, there are petroleum indications on Celebes Island, at Taguntalo, Tomori Bay, Baroko and in the Duri and Manudju Districts on the island of Muna, off the southeast coast of Celebes; and on the island of New Guinea, near the mouth of the Buti River

on the north coast, and at a point on the Iwaka River 200 miles southeast, in a series of coal-bearing formations, about 40 miles from the sea.

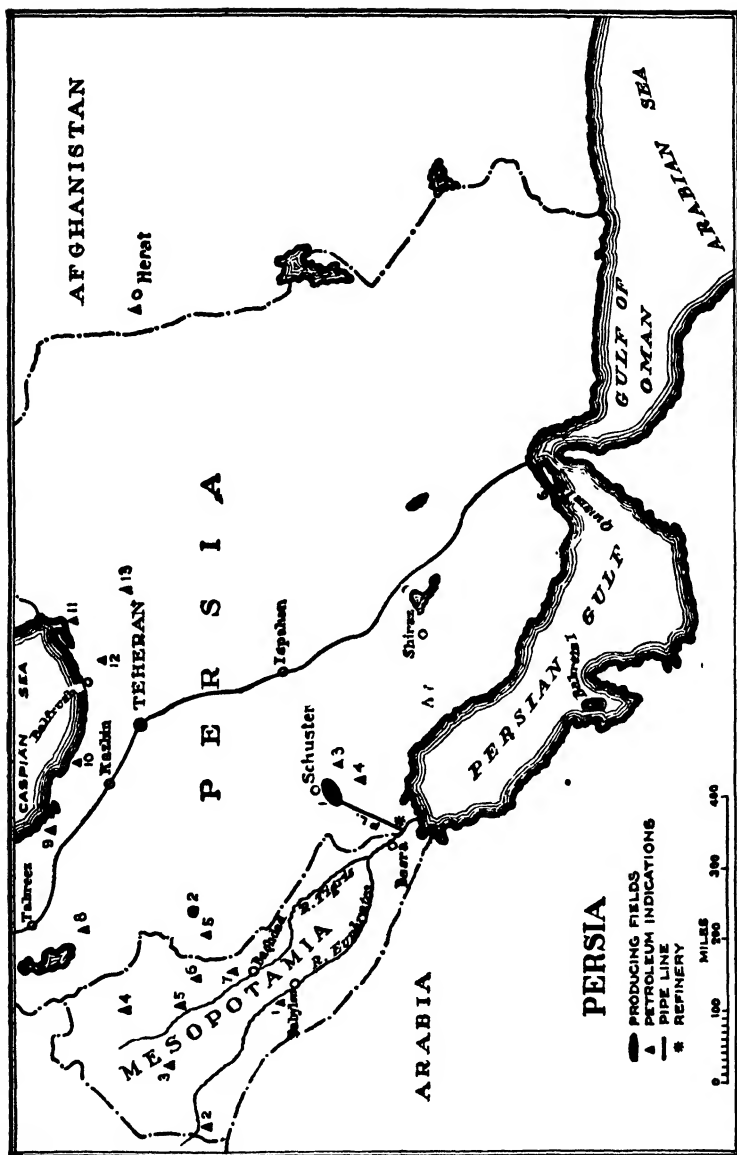
PETROLEUM LEGISLATION

The petroleum legislation of the Dutch East Indies is contained in the Netherlands East Indian Mining Law, amended the 20th of July, 1918, by which the Netherlands Home Government retains ownership and control of its colonial petroleum resources.

Exploration rights are obtained by Government license for a period not exceeding three consecutive years, after the licensed prospectors have agreed to compensate surface owners for damages. The discoverer has no prior exploitation rights, and the Government reserves the right to develop the field itself or to make contracts for development upon a partnership basis, upon terms to be determined by the Government. The arrangements between the Government and an individual or corporate partner, to develop a concession, is in each instance accomplished by a Special Legislative Act of the Home Government, similar to a special incorporation. The Special Act fixes the area of the concessions, defines the relative shares of the Government and its partner in the enterprise, determines the membership of the board of directors, of which the Government retains a majority for the purpose of control, and includes the terms under which the Government will compensate the opening partner, should the Government decide to buy or the partner to sell. The law further provides that prospecting licenses will not be issued to, nor concession contracts made with any but full citizens of the Netherlands domiciled in the Dutch East Indies, nationals having the rights of domiciled persons, or companies having on their boards a majority of Dutch citizens or residents of the Dutch East Indies. There are no restrictions governing the nationality of stockholders of such eligible companies.

In effect, the present petroleum law makes the Netherlands Home Government owner with absolute control of the petroleum

resources of the Dutch East Indies. Concessionaires have the position of managing agents operating for the Government, upon a profit-sharing basis, under a special legislative act or contract with the Netherlands Home Government. The law operates to give the Government control of the exploitation of petroleum and the principal profit from production, and facilitates the taxation of the profits of participating concessionaires.



For names of oil fields see list on page 236

PERSIA

INTRODUCTION

The Kingdom of Persia extends from the Caspian Sea on the north to the Persian Gulf on the south, and is bounded by Mesopotamia on the west, and Turkestan, Afghanistan, and Baluchistan on the east. It has an area of about 628,000 square miles and a population estimated at 10,000,000, giving a density of 16 to the square mile. The majority of the inhabitants are the lineal descendants of the original Aryan population, and speak a language which has for its basic elements the ancient Persian tongue. Except for a narrow coastal plain on the Persian Gulf and the Tigris Valley, the country is an arid, mountainous plateau of over 4000 ft. elevation, which, owing to its high altitude, has a fairly uniform, cold, and dry climate. There are only 350 miles of railroad, consisting of short lines in the northern frontier region and in the south, so transportation is conducted chiefly by caravan and motor over the ancient trade routes. There are about 6000 miles of telegraph lines. Roads and telegraph lines are operated by the Government or concessionaires, as a source of revenue, on a toll basis.

Previous to 1906, the Government was similar to that of Turkey, and the Shah, who obtained his office by direct male succession, was, within the limits of the Moslem religion, an absolute ruler. In December, 1906, because of the demands of the people, the Shah approved a constitution which made Persia a limited monarchy, with legislative power vested in a National Assembly and executive power in the Shah and a Cabinet. The country is divided into thirty-three provinces, each in charge of a Governor General. An American has been appointed by the Persian Government as General Administrator of the Kingdom. The expenses of the Government have, as a rule, been kept within its

revenues. The National Debt is estimated at \$50,000,000, or \$5 per capita.

During the past few years, according to the statistics of the Minister of Finance, imports exceeded exports by over \$20,000,000 per year. The chief exports, in order of their importance, are petroleum, averaging about 50 per cent of the total value; cotton, fruits, and carpets, 8 per cent each; and opium. The chief imports are textiles, sugar, and tea. The bulk of this trade is carried on with the British Empire, Russia, and Egypt. The principal industry is agriculture, and the chief products, which are consumed within the country, are wheat, barley, and rice.

PETROLEUM RESOURCES

PRODUCING FIELDS

General Statement.—Although the oil industry of Persia dates back over a century, when oil was recovered from hand-dug wells near Schuster, in the Bakhtiari region, systematic investigations of the oil resources were really not begun until 1903. The modern history of Persian oil development may be said to have begun in 1909, when oil was encountered in the Schuster region at a depth of 1100 ft. The Persian fields have attracted a great deal of attention in the last few years, on account of the reported high productivity of their flowing wells and the commanding position held by the British Government, through the Anglo-Persian Oil Company which controls a large share of the prospective fields as the result of a liberal concession granted by the Persian Government in 1901.

It should be kept in mind, however, that the area so far proven is but a few square miles, and, important as the results obtained undoubtedly have been, they by no means prove the existence of similar commercial deposits wherever surface indications of petroleum exist. With this in mind, one should discount statements that have appeared in print to the effect that the oil fields extend for 1100 miles along the western frontier of Persia and 700 miles along the shores of the Caspian Sea.

Practically the entire present production comes from the

producing fields near Schuster, 100 to 140 miles from the head of the Persian Gulf. Small yields are obtained also in the Kirmanshah District, about 200 miles northwest of Schuster near the Mesopotamian frontier. The principal producing oil fields in the Schuster District are Maidan-i-Naphtun, Maidan-i-Naftek, and Ahwaz; the first-mentioned field, with an area of about 4 square miles, is the largest producer.

The oil occurs in the Fars series of Miocene age, which consists of marls, clays, sandstones with limestones, and interbedded strata which outcrop over a large area. The Bakhtiari formation, which consists of grits and conglomerates, overlies the Fars series. The reservoir rocks are vesicular, shelly limestones of the lower Fars group, 200 to 300 ft. in thickness. The accumulation takes place along the flanks of the Bakhtiari Mountains. The Maidan-i-Naphtun field is developed on the upper flank of the characteristic anticlinal structure of the region. The Ahwaz field, south of Schuster, lies in the Pusht-i-kuh range, along an anticline striking west-northwest for over 100 miles, with an elongated dome structure in the neighborhood of Ahwaz.

Development and Production.—Many of the producers of the Schuster District are flowing wells, some of which have produced steadily for years; and although the developed area of the district covers only about 4 square miles, it is reported that the production of the wells exceeds the present market requirements. Natural gas occurs with the oil and is used as fuel in the fields. Canadian drilling rigs with wire ropes are commonly used, and, on account of bad boiler water, electrical installations have superseded the steam plants; rotary drilling has also been successfully employed. As there is little trouble from caving, joint casing is commonly used. The wells range from 1100 to 1400 ft. in depth. The commercial production of the Persian fields began in 1910, and by 1912 about 1000 barrels a day were produced. There has been a steady increase in the yield, and it is estimated that the 1922 production reached 18,000,000 barrels.

The production of the Persian fields is shown in the following table:

PRODUCTION OF PETROLEUM IN PERSIA

(in U. S. barrels)

1912 . . .	334,000	1918	6,950,000
1913	626,000	1919	8,370,000
1914 .	2,120,000	1920 . .	10,500,000
1915	2,910,000	1921 . . .	16,672,540
1916. . .	3,480,000	1922 ..	18,000,000 (estimated)
1917.. . . .	5,010,000		

The Persian crude is of paraffin base, has an average gravity of 38.7° Bé. (0.83 sp. gr.), and contains about 5 per cent gasoline, 52 per cent kerosene, 40 per cent lubricating oils, and 2 per cent fuel oil.

The oil from the Maidan-i-Napthan, White Oil Springs, and Ahwaz fields is transported to the refinery on the Island of Abadan in the Persian Gulf, by two pipe lines about 145 miles long, and 10 and 8 in. in diameter, with a capacity of 25,000 barrels a day which will be increased by the lines now under construction. The Karan River is navigable from Ahwaz to the Persian Gulf. The refinery on Abadan Island has a daily capacity of about 6000 barrels; the products include gasoline, kerosene, and fuel oil; and, when the extensions now under construction are completed, there will also be produced gas oil, lubricating oils, paraffin wax, and pitch. Storage tanks with a capacity of 1,500,000 barrels are located at Swansea, where a topping plant is under construction.

The domestic consumption of oil in Persia is relatively small, and most of the output is exported to Egypt and British India. The Persian crude is also being shipped in large quantities to the refinery of the Anglo-Persian Oil Company at Llandarcy, Wales. This plant has a daily capacity of 30,000 barrels and will take care of a large percentage of the British oil trade. Arrangements have recently been made for the construction of tank storage and distributing facilities in some of the leading French ports.

PROSPECTIVE FIELDS

The prospective oil fields of Persia extend along the western and northern frontiers at Qasr-i-Shirin near Kirmanshah. Oil

with a gravity of 41.7° Bé. (0.815 sp. gr.) was encountered in test wells in this region. Petroleum indications are found in the southern section at Quihm Island and in the region about Daliki. The oil occurrences in northern Persia are found in the Lake Urumieh region in Azerbigan, at Anzeli, Shaktesar, and Gumush Tepe on the Caspian Coast, and inland at Schahkuhi-balae, and near Semnan on the edge of the Khorasan.

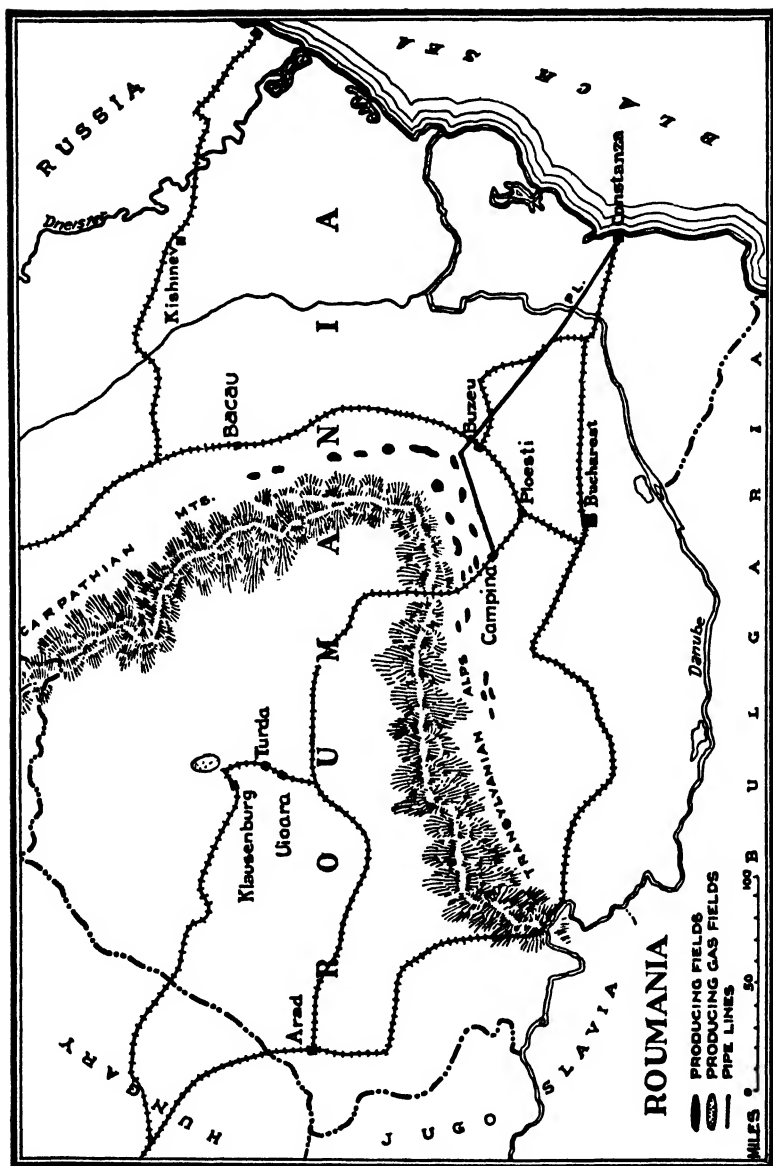
PETROLEUM LEGISLATION

There is no codified general mining law in Persia; the prospecting rights so far given have been obtained by special concession from the Government. Under the terms of the Persian Constitution of 1906, the obtaining of these concessions has become, to a great extent, a political and diplomatic procedure between the Persian Government and the negotiating interests.

The concession of the Anglo-Persian Oil Company, which covers oil exploration and exploitation rights to practically all of Persia, except the five northern provinces, is typical. It gives to W. K. D'Arcy, for sixty years, the exclusive right to drill for, produce, buy, and dispose of the oil and oil products throughout the Persian Empire, except in the five northern provinces. Provisions for an allotment of fully paid shares, a cash payment and a 16 per cent royalty on the net yearly profits is also made under the D'Arcy concession for the benefit of the Persian Government. Subsidiary companies can be formed for exploitation of any special district.

In 1914, the British Government took £1000 of preferred and £2,000,000 of ordinary shares of the Anglo-Persian Oil Company and thus acquired a controlling interest in the operation of the Persian oil fields.

The oil exploration and exploitation rights in the five northern provinces were formerly given to the Russian Government, and it is reported that British and American interests are negotiating with Russia and Persia for their acquisition.



ROUMANIA

INTRODUCTION

Roumania includes the old Kingdom of Roumania and the Provinces of Transylvania, formerly a part of Hungary; Bukovina, formerly a part of Austria; and Bessarabia and Banat, formerly a part of Russia. These acquisitions have more than doubled the area and population of pre-war Roumania. The total area is approximately 120,000 square miles, and the population 17,400,000, including Magyars, Bulgars, Turks, and Tartars, besides the predominating native Roumanians. The official language is Roumanian. Transportation and communication facilities include 28,000 miles of wagon roads, 7000 miles of railroad, and 33,000 miles of telegraph and telephone lines owned and operated by the Government. The Danube traverses the country for a distance of 675 miles, with a depth of 100 ft. in places, and the Dniester is navigable for 120 miles, for boats with a draft of 10 to 15 ft.

The country is a constitutional monarchy in which the King is succeeded by the eldest male heir. A cabinet and a legislature of two houses constitute the Government proper, and local administration is accomplished by division of the Kingdom into districts. Since the War, Roumania has been unable to balance her budget. The National Debt is estimated at \$5,270,000,000.

The country is essentially agricultural, and cereals are the chief export, with petroleum second in importance. Lumber is also an important commodity, as one-fourth of the total area is covered by forests. The chief imports are structural steel, casings, cotton, wagons, tanks, and coal.

PETROLEUM RESOURCES

PRODUCING FIELDS

General Statement.—The petroleum deposits in Roumania are located along a belt 15 to 20 miles wide, extending in a rough right

angle, parallel with the flanks of the Carpathian Mountains, from the Polish frontier above Bacau on the northern side of the angle, southeastward to Buzeu, the apex, and thence westward through Prahova to Dambovitza.

The petroleum in the Prahova District has been utilized since 1750. Prior to 1880, when the first drilling operations were begun at Draganeasa, hand-dug wells had been sunk and the petroleum industry had reached considerable development. Subsequent developments under three leading operating interests brought the production of the Roumanian fields up to 12,029,913 barrels in 1915, which may be regarded as an indication of their productivity under normal conditions.

The fields may be grouped into four districts: the Prahova District, which includes the fields at Campina Poiana, Bustenari, Telega. Baicoi, Tintea, Matita, Aportalachi, Poiana-Verbilen, and Bana-Moreni; the Dambovitza District west of Prahova, which includes Ocnita, Glodemi, Resca, Coliban, and Dchinri; the Buzeu District, east of Prahova, which includes Garata, Berca, and Tega; the Bacau District, north of Buzeu, which includes Moinesa, Solonti, Casin, Campani, and Piatra. There are possibilities of materially extending the present productive area.

Surface indications of petroleum occur as seepages, in connection with the activity of mud volcanoes near Buzeu, and in the form of springs at Prahova closely associated with salt cores or plugs. The oil-bearing strata are chiefly sands and marls, attaining a thickness of about 1800 ft. and interbedded with hard sandstones of Miocene age.

The mountain-making movement to which the formation of the Carpathians is attributed resulted in the folding of sediments at the foot of the mountains along lines paralleling their main axis, with these parallel structures continuing into the sharp western flexure in the region north of Bucharest. The oil fields are situated on the northeastern and southern foothills of the Carpathians, in sharply folded and faulted anticlines. The folding is visibly irregular, with younger rocks often enclosing elevated cores of older formations. Local field structures show a dip away

from the main range, with a heavily faulted, steep, asymmetrical anticline with intrusions or cores of rock salt.

Development and Production.—Although a small number of dug wells are still in operation, the bulk of the production comes from drilled wells. The Canadian system of drilling is the one extensively used, although of late the rotary system is being employed more and more. The wells range in depth from 300 to 1300 ft., and clays, shales, sands, and sandstones are the principal strata encountered. Considerable difficulty is experienced with the caving of water-bearing sands. There are about eight hundred producing wells, seven hundred of which are pumped by the multiple, or jack, system; five hundred of these are in the Prahova District. Steam and gas engines and electric motors are utilized in drilling and pumping.

The production of the Roumanian fields since 1890 is shown in the following table:

PRODUCTION OF PETROLEUM IN ROUMANIA

(in U. S. barrels)

1890	...	383,227	1907	. . . .	8,118,207
1891	...	488,201	1908	. . .	8,252,157
1892	. .	593,175	1909	. .	9,327,278
1893	..	535,655	1910	. .	9,723,806
1894	.....	507,255	1911	....	11,107,450
1895	..	575,200	1912	... .	12,976,232
1896	. .	543,348	1913	. . .	13,554,768
1897	. .	570,886	1914	.....	12,826,579
1898		776,238	1915	....	12,029,913
1899	. .	1,425,777	1916	...	8,945,029
1900	. .	1,628,535	1917	. . .	3,720,760
1901	. .	1,678,320	1918	... .	8,730,235
1902	. .	2,059,935	1919	.. .	6,517,748
1903	. .	2,763,117	1920	... .	7,435,344
1904	...	3,599,026	1921	... .	8,368,000
1905	.....	4,420,987	1922	.....	8,500,000 (estimated)
1906	. . .	6,378,184			

The Roumanian crudes range in gravity from 22° to 51° Bé. (0.923 to 0.773 sp. gr.). The 51° Bé. crude (from Campina and

Bacau) contains 50 per cent gasoline, 38 per cent kerosene, and 12 per cent residuum.

During the German invasion, in 1916, the retreating Roumanian army destroyed large supplies of oil and storage facilities, which have not yet been replaced. Tank cars and other railroad equipment were likewise destroyed. At present, beside the field storage, there is an extensive tank farm at Giurgevo, and there are arrangements for carrying the oil by tank barges at Ratisban on the Danube; at Constantza, on the Black Sea, storage facilities are also available. The fields at Prahova, 185 miles distant, are connected with Constantza by an 8-in. pipe line for crude and a 4-in. pipe line for refined oils. There are 1400 miles of gathering lines in the fields. The storage capacity before the War was estimated at 1,350,000 barrels, while at present there are only 500,000 barrels of tankage available. Extensive modern refineries are located at Campina, Ploesti, and Bereasca, with an aggregate capacity in excess of present production. From 45 to 50 per cent of the total production is consumed in Roumania, with a tendency toward even greater domestic consumption. The remainder is exported, mainly to England, France, Germany, and Egypt.

PROSPECTIVE FIELDS

Besides extensions of the present producing regions, either by encountering deeper sands or enlarging the present limits, there are possibilities of discovering entirely new pools, for petroleum indications are found in the Ogtoz Valley and at Rabatlyas, Zabola, and Gelentz, in the Province of Transylvania. Traces of asphalt are also reported in the coal-bearing beds in the southwest corner of Transylvania.

NATURAL GAS FIELDS

The largest natural gas field in Europe, and one of the most important in the world, is situated in the Department of Cojocua in Transylvania, formerly a part of Hungary. The Hungarian

Government drilled a well in 1907, at Sharmashel near Cojocua, while exploring for potassium salts, and at a fairly shallow depth encountered a large flow of natural gas. At present there are about forty wells producing approximately 100,000,000 cu. ft. per day. The industry has developed rapidly, and the gas is transported about 50 miles to the industrial regions around Turda and Uioara, in 8-in. pipe lines.

PETROLEUM LEGISLATION

Under the present law, the owner of the surface owns the subsoil, but the question of the nationalization of the subsoil is now under consideration. The proposed law will honor the subsoil rights of landowners in the present zone of petroleum activities, but in lands where no prospecting has been done, the subsoil may become the property of the State. The rights of the present owner will probably be recognized by means of a royalty.

INDIA

INTRODUCTION

India lies in the southern part of Asia, and includes fourteen British provinces and about seven hundred native states. It has an area of 1,802,000 square miles and a population of 319,000,000, giving a density of 177 to the square mile. The three main languages are Hindustani, Bengalese, and Telugian. The climate of the country is tropical, with alternating dry and rainy seasons. The transportation and communication facilities include 40,000 miles of railroad, 200,000 miles of wagon roads, 3200 miles of canals, and 88,500 miles of telegraph lines. The Government either owns and operates or subsidizes the railroad, telegraph, and telephone lines.

The British provinces are governed as a colony, and the native Indian states as a protectorate. Administrative functions are vested in a Governor General, or Viceroy, appointed by the King. The Governor holds office for five years, and is assisted in India by an Executive Council, and in England by the Secretary of State of India. For a number of years, Government revenues have exceeded expenditures. The National Debt is estimated at \$2,263,000,000.

Agriculture is the principal industry, with rice, wheat, jute, and cotton as the chief products. India is the first jute-producing country of the world, and stands second in the production of cotton, yielding 20 per cent of the entire production. The chief exports, in order of their importance, are jute, cotton, and rice; the chief imports are cotton manufactures, metals, machinery, and sugar. The foreign trade is controlled by Great Britain, the United States, and Japan. Great Britain purchases about 40 per cent of the exports and furnishes 60 per cent of the imports.

PETROLEUM RESOURCES

General Statement.—The production of petroleum in India is practically confined to Burma, where, as early as 1880, the hand-dug wells of the Irrawaddy District yielded important quantities. Subsequent developments have centered in this district which, while limited to the small area of the Yenangyat-Singu and Yenangyaung fields, has been, since 1891, the chief source of India's oil output. Other regions, in the order of their importance, are Assam, Punjab, and the prospective regions of Baluchistan. These fields are for the most part controlled by British interests.

The production of India since 1889 is shown in the following table:

PRODUCTION OF PETROLEUM IN INDIA

(in U. S barrels)

1889	. .	94,250	1906.	. . .	4,015,803
1890	.	118,065	1907		4,344,162
1891	.	190,131	1908.	. . .	5,047,038
1892		242,284	1909	.	6,676,517
1893		298,969	1910		6,137,990
1894		327,218	1911		6,451,203
1895		371,536	1912		7,116,672
1896	.	429,979	1913		7,930,149
1897	.	545,704	1914		7,409,792
1898		542,110	1915		8,202,674
1899		940,971	1916		8,491,137
1900	.	1,078,264	1917		8,078,843
1901		1,430,716	1918		8,000,000
1902.	. .	1,617,363	1919	.	8,453,800
1903	.	2,510,259	1920	.	7,500,000
1904	. .	3,385,468	1921	.	6,864,000
1905.		4,137,098	1922	.	6,500,000 (estimated)

BURMA

General Statement.—The chief oil-producing district of India is in upper Burma near the Irrawaddy River, about 300 miles

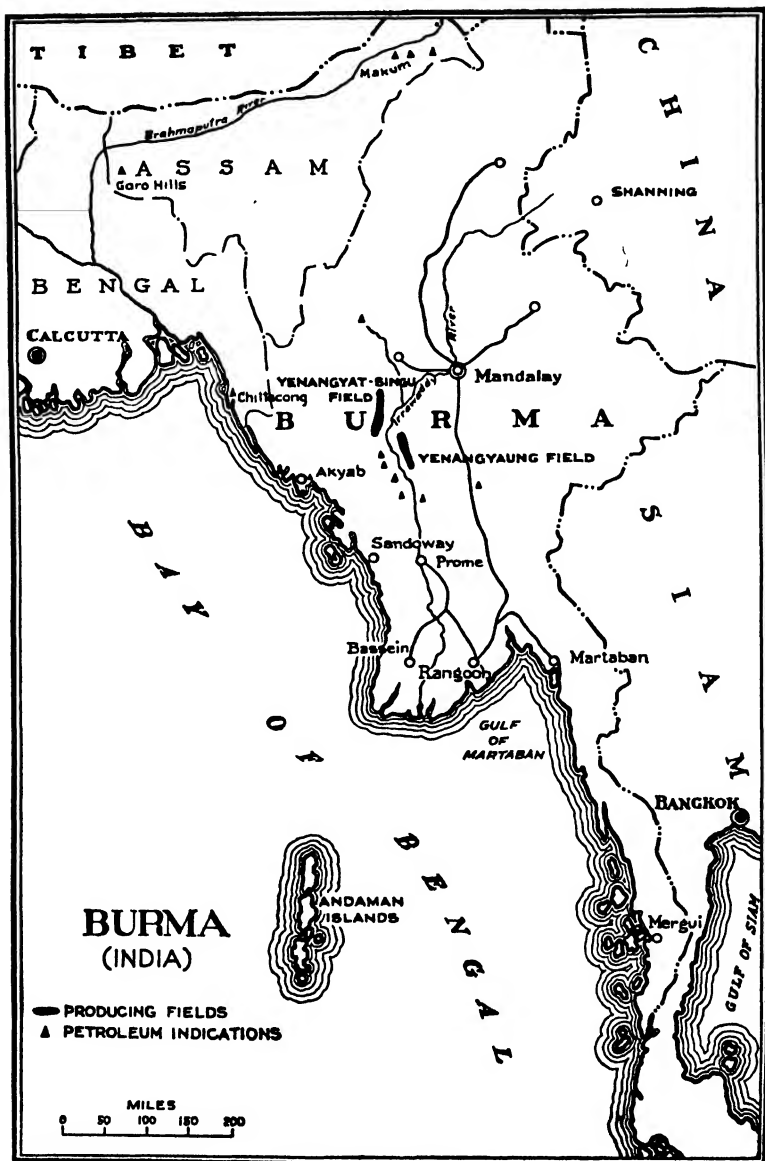
north of Rangoon and 130 miles south of Mandalay. The Irrawaddy District includes the Yenangyat-Singu and Yenangyaung fields, the combined output of which equals 70 per cent of India's total production. The productive area of the district is about 1000 acres; attempts to extend operations at Minbu, 18 miles farther south, and in the Yenangyat-Singu field have met with declining yields after large initial production. Minor producing regions capable of further development are the upper Chindwin field, northwest of the Irrawaddy District; Thayet-Migo; Kyawkpyn; and Akyab, southeast of the Irrawaddy District on the Bay of Bengal.

In the Irrawaddy fields the oil occurs in the Pegu sands of the lower Miocene at depths from 400 to 1000 ft. The regional structure of the district is a series of elongated domes and sharp anticlines, which have been cut by erosion into elliptical ridges, intersected by ravines, exposing the soft Pegu sands clays, and calcareous sandstone. The Yenangyat-Singu fields are marked by undulating asymmetrical anticlines, while the Yenangyaung fields are developed by a faulted, elliptical dome.

Development and Production.—The Burma wells range in depth from 400 to 2100 ft. and are, as a rule, small producers. The American cable system of drilling has been principally employed, although Canadian pole tools have also been used. Pumping is used extensively, except in the Singu field where flowing wells are obtained under strong gas pressure. Natural gas also occurs in the Yenangyaung field when the wells are first brought in, but is quickly exhausted. Practically the entire production of India comes from this district.

The Yenangyaung crude has a gravity of 43.8° Bé. (0.81 sp. gr.) and contains 9 per cent gasoline, 63 per cent kerosene, and 26 per cent lubricating oils; while the Yenangyat-Singu crude, with a gravity of 30° Bé. (0.875 sp. gr.), contains 4 per cent gasoline, 34 per cent kerosene, 50 per cent lubricating oils, 5 per cent fuel oil, and 6 per cent paraffin.

The oil is transported from the Yenangyat-Singu fields to Yenangyaung by a pipe line 48 miles long, whence it is pumped



to Syriam near Rangoon, through a 10-in. pipe line 275 miles long; oil is also brought down to the refineries at Syriam and Bogyok by river steamers. There are refineries at Dunneedaw, Syriam, and Bogyok in the immediate vicinity of Rangoon, and one near the field at Yenangyat with a capacity of 13,000 barrels of crude oil per day. The refined oils are loaded on tank steamers at the Rangoon River by pipe lines from the Syriam refinery, 5 miles away. Kerosene is the principal petroleum product of the Burma crudes and is entirely absorbed by the Indian market, as are all the other products with the exception of gasoline. Paraffin wax is purchased principally by Japan, Great Britain, and Australia; candles by Ceylon and Egypt.

Prospective Fields.—Among the prospective regions of Burma may be noted the Yenau District on the Yu River in the upper Chindwin Valley, the Indwin District about 70 miles to the southwest, and Zanalok and Pinkadin brooks in the lower Chindwin District where favorable indications of oil are reported. In the coastal belt, which is a southern extension of the lower Miocene formation of the Irrawaddy District, petroleum indications exist on Baranga, Cheduba and smaller islands below Akyab, and at intervening points in the mainland about 150 miles south of the Irrawaddy fields.

ASSAM

General Statement.—The producing areas of Assam lie in the valleys of the Noa Dilring and Buri Dilring Rivers in northeastern Assam. The producing fields, in the order of their importance, are Digboi, Makum, and Buddepore; they are located within a concession area of about 12 square miles. The surface evidences of oil are associated with coal seams, and the oil is found in lenses of unconsolidated sand, interbedded with clay of Eocene and Miocene age. In the Makum field the operations have been rendered more difficult by the intrusion of salt water.

Development and Production.—Although the wells are, as a rule, small producers, flowing wells have been developed in the

Digboi field by the Assam Railways and Trading Company, which controls the Digboi and Makum fields. Rotary drilling is now employed in preference to the percussion method. Natural gas generally accompanies the oil.

The Assam crude has a gravity of 36.6° Bé. (0.84 sp. gr.) and contains 9 per cent gasoline, 38 per cent kerosene, 49 per cent lubricating oils, and 3 per cent fuel oil.

All the oil produced is refined at Digboi, and kerosene, lubricants, and paraffin are obtained as the chief products. The kerosene is consumed in the Assam Valley, the heavier oils are absorbed by the Calcutta market, and the paraffin wax is exported. British interests control the Assam oil industry.

Prospective Fields.—Petroleum indications are found in the Klian and Garo hills in the southwestern part of Assam, and near Chittagong in the southeastern part near the Bengal Coast

PUNJAB

General Statement.—The Punjab oil region is situated in the extreme northwestern section of British India, between Kashmir and Kabul. The Rawal Pindi District, near the center of this area, contains the more numerous oil indications. Oil seepages are found in Eocene limestones and sandstones, near the crest of steep anticlines, at Gunda and at Kham in the adjacent Attock District, where prospect drilling has been carried on.

Development and Production.—The development of the Punjab oil areas began in 1891, when the Gunda field yielded about 45 barrels in 1918 the total output reached 18,000 barrels of 25° Bé. (0.907 sp. gr.) oil. Scanty information is available concerning the drilling methods, well depths, and actual area of the oil fields under development in the Punjab. It is reported that flowing wells of moderate depths have been drilled at Khaur.

There is a small refinery, owned and operated by British interests, at Kham near Rawal Pindi, where the output of the Kham and Gunda fields is handled. The entire output is utilized by the British Government and adjoining municipalities.

Prospective Fields.—The prospective fields of the Punjab are located at Mogalkot in the southwestern part, and at Rohri in the Sukkur District where trial borings have shown favorable prospects. The oil found at Mogalkot has a gravity of 40.9° Bé. (0.819 sp. gr.). Other petroleum evidences are reported in the South Rana State, about 80 miles south of Benares.

MISCELLANEOUS PROSPECTIVE FIELDS

There are oil indications on the west coast at Calicut and at Alleppy where the oil exudes from mud-banks. As early as 1884, small volumes of oil had been discovered in northeastern Baluchistan at Khatan, about 40 miles east of Sibi Station on the Quetta Branch Railway. Four wells were drilled, and several years later, when operations were abandoned, a total of 100,000 barrels is said to have been produced. The Khatan oil has a gravity of 11° Bé. (0.993 sp. gr.) and is separated from the accompanying water with great difficulty.

PETROLEUM LEGISLATION

A license from the local Government is necessary in order to operate for petroleum upon the public lands of India; and only a British subject, or a British-controlled company, may obtain such a license, or a concession or a lease. Rights so granted can not be transferred to foreigners. On private lands the owner may freely explore or exploit the mineral products of his land, or he may lease the same for such purpose.

The Government of India has under consideration at this time a revision of the provisions of the mining laws relative to leases and prospecting licenses for oil. One of the proposals under consideration is an extension of the time limit of prospecting licenses, for it has been shown that the present period of one year is not sufficient for the testing of an oil property. It has also been suggested that local Governments should be empowered, where

sufficient reasons exist, to grant mining leases for oil for a larger area than the rules at present permit. Should the Government of India decide to recommend any changes, the matter will have to be referred to the Secretary of State for sanction, which implies that the revised rules cannot take effect for some time to come.



POLAND

INTRODUCTION

The Republic of Poland includes pre-war Russian, German, and Austro-Hungarian Poland, and the province of Galicia, formerly part of Hungary. It has an area of about 149,000 square miles and a population estimated at 26,000,000, with a density of 174 per square mile. Although the Carpathian Mountains are partly within Poland, the country is mainly a broad plain, with an average elevation of 460 ft., broken only by river channels. Transportation and communication facilities include 11,600 miles of railroads, 1200 miles of navigable rivers and canals, 30,000 miles of wagon roads, and 64,000 miles of telegraph and telephone lines. Poland has access to the Baltic Sea through the Free City of Danzig and a coastline of about 50 miles.

In 1918, Poland was organized as a republic, with parliamentary government, based on universal suffrage. The President is elected for seven years. The Government had a budget deficit of \$38,000,000,000 in 1922; the National Debt is estimated at \$69,000,000,000.

Seventy per cent of the population is engaged in agriculture; cereals and sugar beets are the principal products. No detailed information concerning the exports and imports is available; the bulk of the foreign trade is carried on with Germany.

PETROLEUM RESOURCES

PRODUCING FIELDS

General Statement.—The Galician or Polish oil fields extend along the northern flanks of the Carpathian Mountains, from the Valley of the Dunajic to the Valley of the Czeremoiz. The geographical, as well as the commercial, center of the industry

is the Boryslaw-Tustanowice District, 70 miles southwest of Lemberg, which yields 90 per cent of the entire production. The remaining 10 per cent comes from the region around Krosno, about 100 miles northeast of Boryslaw, which includes the fields at Gorlice, Bobrka, Rogi, and Krosno; and the region near Kolomea, about 100 miles southwest of Boryslaw, which includes the fields at Slaboda, Starunia, and Kormacz.

The formations involved in the geology of the Galician fields are of Tertiary and Cretaceous age, with oil reservoirs occurring for the most part in the Eocene. Unconsolidated sediments with conglomerate clays and sands predominate. Oil of paraffin base occurs from the Miocene to the Eocene, while the non-paraffin crude is generally derived from the Cretaceous or older Tertiary beds. The accumulation takes place along complex anticlinal folds, overturned in some places, and in others in close proximity to the overthrust older sediments. Salt cores are associated with the structure in many fields, and play a very important part in the distribution of the deposits.

Development and Production.—Boryslaw and Tustanowice are now the site of the most important oil fields in Poland. Work was begun in 1850, and in 1902 the largest well had a daily output of 3000 barrels. There are now about 185 wells, 45 at Boryslaw and 140 at Tustanowice. The drilling difficulties in this section are probably not duplicated in any other producing district; the great depth of the oil strata and the alternately loose and hard beds, which usually lie at a very steep angle, make well-drilling an expensive and hazardous undertaking. A modified Canadian method of drilling has been devised by using solid iron instead of wooden rods, and wells of 5000 ft. in depth are, as a rule, successfully drilled. The usual depth of wells in the Boryslaw District ranges between 4000 and 4500 ft. Such wells cost about \$100,000 and require from three to four years for completion. The deepest drilling in the world is done in these fields, and wells over one mile in depth are good producers. The field produces about 20,000 barrels a day. Many of the old pools are now flooded by salt water.

The production of the Polish fields since 1890 is shown in following table:

PRODUCTION OF PETROLEUM IN POLAND

(in U. S. barrels)

1890	659,012	1907	8,455,841
1891	630,730	1908	12,612,295
1892	646,220	1909	14,932,799
1893	692,669	1910	12,673,688
1894	949,146	1911	10,519,270
1895	1,452,999	1912	8,535,174
1896	2,443,080	1913	7,818,130
1897	2,226,368	1914	5,033,350
1898	2,376,108	1915	4,158,899
1899	2,313,047	1916	6,461,706
1900	2,346,505	1917	5,965,447
1901	3,251,544	1918	5,591,620
1902	4,142,159	1919	6,255,300
1903	5,234,475	1920	5,606,116
1904	5,947,383	1921	5,167,000
1905	5,765,317	1922	4,000,000 (estimated)
1906	5,467,967		

About 80 per cent, the standard Galician crude, has a gravity of 34.3° Bé. (0.852 sp. gr.) and contains 12 per cent gasoline, 37 per cent kerosene, 31 per cent lubricating oils, 4 per cent fuel oil, and 9 per cent paraffin. The remaining 20 per cent, the special crude, has a gravity of 45° Bé. (0.80 sp. gr.) and contains 20 per cent gasoline, 43 per cent kerosene, 10 per cent gas oil, and 15 per cent lubricating oils.

The fields are able to produce more oil than can be handled, and the storage, with a capacity of 6,500,000 barrels, is full. The lack of tank cars is the main drawback in transportation. There are 15 large and 50 small refineries, with an aggregate capacity of 8,160,000 barrels a year. Poland consumed in 1921 about 210,000 tons of petroleum products, about 36 per cent of the production; the remaining 64 per cent was exported.

PROSPECTIVE FIELDS

The oil possibilities extend interruptedly for about 370 miles along the flanks of the Carpathian Mountains. The regions around Krosno and Kolemea are among the important prospective fields.

OZOKERITE

The only deposits of ozokerite commercially operated are associated with the Polish oil fields, particularly in the Boryslaw District. The industry dates back to 1860, when ozokerite was first mined in Boryslaw; there are also deposits at Dzeinacz and Starunia.

In addition to light oils, the crude ozokerite yields a semi-solid product resembling vaseline, known as "yellow ozokerite." This is used by French perfumers, as a substitute for lard in ointments and pomades, because it does not become rancid and is therefore superior to animal fat. The purified ozokerite, which bears the name of ceresin, is often artificially colored to resemble beeswax, and is used largely as a substitute for beeswax in the manufacture of church candles. The production, from 1900 to 1913 inclusive, averaged close to 2000 metric tons per year, with a gradual decline since 1905, when it reached close to 3000 tons. The industry was practically at a standstill during the War. At present the production averages about 200 tons per year.

PETROLEUM LEGISLATION

The owner of the surface owns the subsoil, and oil lands may be purchased or sold at will, without Government concessions and without regard to nationality. Mineral rights are not reserved to the State, but the State is a large owner of petroleum-bearing lands, which are now being sold to private concerns. A project is being considered whereby Government aid may be extended to the producer, probably by a subsidy, to encourage production. In Rus-

sian Poland, the State petroleum monopoly, handed down by the Russian régime, still exists.

At present, French capital predominates in the control of the industry, with English second. Since the War, French interests have purchased extensive acreage from private owners.

The royalty paid to landowners averages 20 per cent of the oil produced, and the Government taxes an additional 15 per cent, which brings the total royalty paid by the operator close to 35 per cent.



PERU

INTRODUCTION

The Republic of Peru, in western South America, has an area of about 722,000 square miles and a population of 5,800,000, comprising Indians, 60 per cent; mixed races, 30 per cent; and whites of Spanish extraction, 10 per cent. Spanish is the official language. Although Peru is situated entirely in the Torrid Zone, because of the varying altitudes, the country may be divided into three sections: the strip of arid land from 25 to 60 miles in width along the Pacific Coast, the high interior plateau between the coast range and the main body of the Andes, and the densely wooded eastern slopes of the upper Amazon basin. Transportation facilities include the tributaries of the upper Amazon in the eastern plains, which are used for transport to the Atlantic ports of Brazil, about 575 miles of wagon roads, and 2000 miles of railroad. There are about 8800 miles of telegraph line.

In 1824 Peru gained her independence from Spain, and soon afterward the Republic was organized. The President is elected for five years and cannot be a candidate for re-election. In 1890, because of increasing debts, Peru made a contract with the London Corporation of Foreign Bondholders, giving that organization certain concessions over guano deposits (part has since reverted to the Chilean Government), mines, lands, and control of the State railways until 1956, in return for which this organization assumed all responsibility for Peru's foreign debt. The National Debt which has accumulated since that time, and for which Peru is responsible, is estimated at \$29,000,000.

As practically no raw materials need to be imported, the balance of trade has for many years been in Peru's favor. The

exports, in order of their importance, are sugar, cotton, copper, and petroleum. Small quantities of coal, wheat, and lumber are imported. Agriculture and mining are the leading industries.

PETROLEUM RESOURCES

General Statement.—The commercial oil fields of Peru lie in the Provinces of Tumbes and Payta, along the northern coast near the Ecuadorian boundary. The most southerly and most important field is Negritos, in the Province of Payta. About 20 miles north of this lies the Lobitos field, which is second in importance; still farther north, about 60 miles from Lobitos, is the Zorritos field.

The production of the Peruvian fields is shown in the following table:

PRODUCTION OF PETROLEUM IN PERU

(in U. S. barrels)

1896.....	47,536	1910	.. 1,330,105
1897.....	70,831	1911	1,368,274
1898	70,905	1912	1,751,143
1899	89,166	1913	2,133,261
1900	274,800	1914	1,917,802
1901.....	274,800	1915	2,487,251
1902.....	286,725	1916	2,550,645
1903... ..	278,092	1917	2,533,417
1904. . .	345,834	1918	2,458,376
1905. . . .	447,880	1919 .	2,561,291
1906	536,294	1920 .	2,816,649
1907	756,226	1921 .	3,699,280
1908. . . .	1,011,180	1922... .	3,900,000 (estimated)
1909.....	1,316,118		

NEGRITOS

The Negritos District, which includes the coastal fields of Negritos and the Lagunitas area farther inland, was discovered in testing numerous oil seepages associated with the exposed rocks. The formations involved in the geology of the field are sediments

of Tertiary age, in which sands, clays, and conglomerates predominate. The oil occurs in from two to seven distinct sands, the greater number of which have been encountered by drilling to about 4000 ft. The accumulation takes place along an anticlinal fold, locally complicated by faulting, which probably extends off the coast below tidewater.

The first productive well in Negritos was drilled about 1891, and by 1907 there were over 200 producing wells. At present it is estimated that there have been drilled in the Negritos and Lagunitas areas over 1000 wells, of which about 750 are producing. All the wells are pumped, and range in depth from 300 to 4000 ft.

The production of the Negritos and Lagunitas fields since 1905 is shown in the following table:

PRODUCTION OF PETROLEUM IN THE NEGRITOS AND LAGUNITAS FIELDS
(in U. S. barrels)

1905	335,160	1914	1,032,210
1906	330,510	1915	1,355,925
1907	396,750	1916	1,822,733
1908	543,750	1917	1,771,560
1909	740,070	1918	1,820,814
1910	773,025	1919	1,738,400 (estimated)
1911	882,698	1920	1,968,000 "
1912	1,071,000	1921	2,752,000 "
1913	1,136,490	1922	2,800,000 "

The Negritos crude resembles in some measure the Pennsylvania oils. It has a gravity of 33.7° Bé. (0.855 sp. gr.) and contains 11 per cent gasoline, 42 per cent kerosene, and 41 per cent lubricating oils.

Part of the production is refined at the port of Talara near the field, and the remainder is shipped to Canada for refining.

LOBITOS

The Lobitos field lies along the coast about 20 miles north of Negritos, and is second to it in importance. The surface evidences of petroleum in this area are well defined and consist of seepages,

gas springs, and mud volcanoes in middle Tertiary sediments. Four producing sands have been encountered. The oil accumulates along a well-defined anticline modified by local faulting; there are also indications of secondary folding.

Exploration began about 1900, and it is estimated that there are at present about 150 producing wells which range in depth from 400 to 2500 ft. and produce from 10 to 400 barrels per day.

The production of the Lobitos field since 1905 is shown in the following table:

PRODUCTION OF PETROLEUM IN LOBITOS

(in U. S. barrels)

1905....	75,000	1914....	504,743
1906....	162,000	1915....	664,972
1907...	279,000	1916....	654,060
1908....	319,898	1917....	686,595
1909....	429,195	1918....	639,098
1910... .	400,080	1919....	682,000 (estimated)
1911....	391,290	1920....	748,400 "
1912....	587,048	1921....	824,000 "
1913....	557,355	1922....	900,000 "

The gravity and composition of the Lobitos crude, which is shipped to California for refining, resembles that of Negritos.

ZORRITOS

The Zorritos field is located about 60 miles north of Lobitos near the Ecuadorian frontier, and has the smallest output of any of the producing fields. It is developed along a narrow, sharp anticline that runs parallel with the coast; this fold is faulted longitudinally.

Exploration of the Zorritos field began in 1870, but was soon suspended until 1883. Commercial production was obtained in 1896, and at present it is estimated that about 350 wells have been drilled, ranging from 600 to 850 ft. in depth, with a steady daily output of about 200 barrels.

The production of the Zorritos field since 1905 is shown in the following table:

PRODUCTION OF PETROLEUM IN ZORRITOS

(in U. S. barrels)

1905.... . .	37,720	1914..... .	88,136
1906.... . .	42,419	1915..... .	72,736
1907.... . .	65,476	1916.... . .	73,852
1908.... . .	71,429	1917.... . .	75,262
1909.... . .	70,750	1918.... . .	76,190
1910.... . .	107,000	1919.... . .	82,480 (estimated)
1911.... . .	64,286	1920.... . .	89,320 “
1912.... . .	78,095	1921.... . .	101,280 “
1913.... . .	83,343	1922..... .	120,000 “

The gravity and composition of the Zorritos crude resembles that of the other Peruvian fields. The oil is refined at Zorritos and marketed in Peru.

PROSPECTIVE FIELDS

There are several prospective oil regions in Peru, among which may be mentioned the area midway between Lobitos and Zorritos and about 20 miles inland, where oil is encountered at La Brieta. A small production has also been obtained on the northern shore of Lake Titicaca on the high plateau in the southeastern part of Peru.

PETROLEUM LEGISLATION

In accordance with the General Mining Code of 1909 and the Petroleum Law of the 2d of January, 1922, deposits of petroleum are national property.

Concessions of exploration will be granted for areas not exceeding 15,000 pertenencias in the coast region, 20,000 away from the coast, and 30,000 in the mountainous districts. These concessions run for a period of two years, and may be extended for two more at the discretion of the Executive, upon payment of an initial deposit which will be returned after the obligations

of the concessionaire have been fulfilled, and payment of an annual exploration tax. The explorer has the right to the products discovered during the exploration work.

Concessions of exploitation will be granted to the explorer for an indefinite period, without respect to nationality, except in lands located within 30 miles of the frontiers which only natives are entitled to hold. An annual tax is paid to the Government before production is obtained, and afterwards a royalty of 6 to 10 per cent of the gross production, in money or in oil.

Excess production may be exported only after the needs of the country are supplied, and exploiting companies must offer at least 25 per cent of their shares for sale to the State or to Peruvian capitalists. Concessions may not be transferred without the consent of the Executive, and a tax of 5 per cent of the transfer price is levied.

On private lands, no prospecting may be carried on without a license from the owner, but after the concession has been granted the exploiter has a right to acquire from the proprietor the surface required for his exploitation.

Titles obtained prior to the enactment of this law may be reformed in accordance with it upon payment of the required taxes.

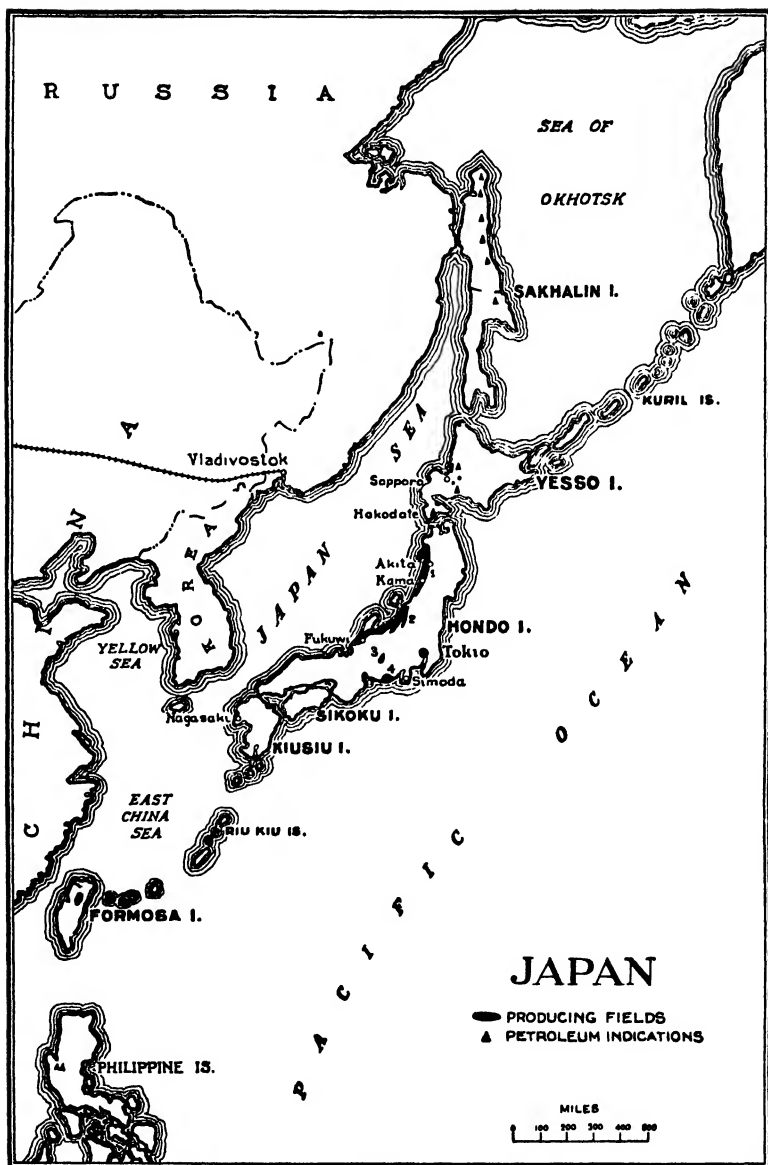
JAPAN

INTRODUCTION

The Japanese Empire includes five principal islands and a number of smaller ones, Korea, and the southern half of Sakhalin Island. Many of these islands are mountainous, and volcanic activity is prevalent in some. These possessions, which extend for about 2700 miles, paralleling the eastern coast of Asia, have a total area of 260,000 square miles and a population of about 77,000,000, with a density of 296 per square mile. Four great steamer lines, subsidized by the Government, connect Japan with Europe, North and South America, and Australia; there are also lines between Japan and China and other Asiatic ports. Internal transportation and communication facilities include 8000 miles of railroad and about 30,000 miles of telegraph and telephone lines.

Japan is a constitutional monarchy, with executive power vested in the Emperor and Cabinet ministers, and legislative power in the Imperial Diet, consisting of a House of Peers and a House of Representatives. For many years, government revenues have exceeded expenditures, but increased expenditures caused a budget deficit, in 1922, of about \$15,000,000. The National Debt is estimated at \$1,713,000,000, or \$22.25 per capita.

Agriculture and manufacturing are the principal industries, with rice, barley, rye, and wheat as the chief agricultural products. The chief exports, in order of their importance, are raw silk, cotton tissues, and coal; the imports are raw cotton, machinery, iron plates, oil cake, and sugar. More than 70 per cent of Japan's foreign trade, both export and import, is carried on with the United States, China, and the British Empire.



PETROLEUM RESOURCES

PRODUCING FIELDS

General Statement.—Although oil indications are numerous in the islands of Yesso and Hondo, the important productive fields are confined to the western part of Hondo, in the Akita and Niigata prefectures. Of the fourteen fields in these two districts, the Kurokawa field in the Akita prefecture and the Niitzu field in the Niigata prefecture produce about 90 per cent of the total yield of Japan. A small production is obtained from the Nagano field in the Shinano Province about 100 miles west of Tokio, and from the Sagara field along the coast about 110 miles southwest of Tokio.

The oil in the Japanese fields occurs in sands associated with sedimentary rocks of Tertiary age. The formation consists of volcanic tuffs, interbedded with shales; the sandstone and tuffs are the chief oil reservoirs. There are three distinct oil-bearing beds in Akita and Niigata, but the middle and lower zones are the most productive. The prevailing structure in these fields is anticlinal.

Development and Production.—As early as 1875, the Japanese fields were producing oil, but it was not until 1901 that the annual yield exceeded 1,000,000 barrels; the production from 1901 to date has fluctuated, reaching a maximum in 1915 and 1916, with a yearly average of 3,000,000 barrels. During the last three years the production has been more or less stationary with a slight upward tendency; the 1922 production is estimated at close to 2,600,000 barrels.

The well production is small, averaging about 1 barrel per well per day. In 1914 the first gusher was encountered in the Akita prefecture, and was responsible for the maximum yields obtained during the two succeeding years. One of these gushers was credited with a production of 10,000 barrels per day, but this soon declined and the total yield of the country was not greatly affected. Previous to 1913, primitive drilling methods were employed; but in that year 50 California rotary rigs were introduced and

operated with success. Natural gas is used for fuel and, in 15 plants, for the manufacture of gasoline by compression and absorption. The wells usually have a depth of 600 to 2000 ft., although wells deeper than 3000 have lately been drilled with the rotary.

The production of the Japanese fields since 1890 is shown in the following table:

PRODUCTION OF PETROLEUM IN JAPAN

(in U. S. barrels)

1890	.....	51,420	1907..	2,001,838
1891	.. ..	52,917	1908	2,070,145
1892	...	68,901	1909	1,889,563
1893.	.. .	106,384	1910	1,930,661
1894	..	171,744	1911	1,658,903
1895	..	141,310	1912	1,671,405
1896	..	197,082	1913	1,942,009
1897..		218,559	1914	2,738,378
1898.	.. .	265,389	1915.	3,118,464
1899	...	536,079	1916	2,997,178
1900.	....	866,814	1917	2,882,378
1901.	.. .	1,110,790	1918	2,449,069
1902.	.. .	1,193,038	1919	2,120,500
1903.	....	1,209,371	1920	2,139,177
1904.....		1,419,473	1921	2,600,000
1905	.....	1,472,804	1922.....	2,600,000 (estimated)
1906.....		1,710,768		

The Japanese crude has a gravity of 37.9° Bé. (0.834 sp. gr.) and contains 26 per cent gasoline, 48 per cent kerosene, and 6 per cent lubricating oils.

The oil is transported from the fields by pipe line to the refineries situated at Kaskiwazaki, Niigata, Akita, Niitsu, and Navetsu, near Echigo, whence it is shipped either by water or rail to the many consuming centers of the island. All the oil produced in Japan is consumed in the country, the requirements of which are greatly in excess of the home production. The importation of American and East Indian oils makes up for the domestic shortage. The industry is controlled by the Nippon and Hohden Companies, which were consolidated in October 1921 and now

operate under the name of the Nippon Oil Company; this company produces one-third of the total output of Japan.

PROSPECTIVE FIELDS

The oil indications extend interruptedly from Sagara on the southern coast, west of Tokio, north through the province of Chinano and thence along the western coast, through the provinces of Echigo and Akita, to the northern part of the island. Indications also exist in the neighboring Island of Yesso, particularly in the southwestern part; in the Island of Sakhalin, the southern part of which is owned by Japan; and in the Island of Formosa, southwest of Japan, which has for many years produced a few thousand barrels of oil per year. At present the possibilities of other areas in the northwestern part of Formosa are being tested by the Japanese Navy.

PETROLEUM LEGISLATION

Petroleum legislation in Japan is regulated by the Mining Code, promulgated on the 7th of March, 1905, which provides that all unmined minerals are the property of the State.

Persons wishing to engage in prospecting or mining must apply to the Chief of the Mine Inspection Office for a mining area of about 826 acres, but this limit may be exceeded. The explorer, upon receiving a permit, may enter upon land belonging to any person, to make surveys or inspections upon payment of just compensation.

When mining rights have been acquired, the lands which the exploiter may need may be expropriated and the title vested in the exploiter. No persons other than subjects of the Empire are entitled to acquire mining rights. It is practically impossible for foreign companies to transfer or retain mining rights in the Empire.

Considerable interest attaches to the development of Sakhalin Island, owing to the concessions recently acquired by American interests in the Russian or northern half of the island. Japanese interests were also making efforts to obtain these rights,

TRINIDAD ISLAND

INTRODUCTION

The Island of Trinidad is the most prosperous of the British possessions in the Caribbean Sea. It lies northeast of Venezuela near the mouth of the Orinoco, and has an area of 1862 square miles and a population estimated at 360,000, composed largely of natives of the West Indies of African descent and East Indian immigrants. The white population includes English, French, Spanish, and Portuguese. English is the official language. Transportation and communication facilities include 124 miles of railroad, 1725 miles of wagon roads, and 170 miles of telegraph line.

Trinidad is an English colony, and the Government is administered by an appointed Governor and Executive and Legislative Councils. Official figures for 1921 show a surplus of revenue over expenditure of about \$1,000,000. The National Debt is estimated at \$1,000,000.

The principal industries are agriculture and petroleum development. The chief exports, in order of their importance, are cocoa, sugar, crude and refined oils; the imports are cotton goods, machinery, and lumber. The bulk of the foreign trade is carried on with the United States, Great Britain, Canada, and Venezuela.

PETROLEUM RESOURCES

General Statement.—Attempts to obtain oil production in Trinidad date back to 1870, but the first successful wells were not drilled until 1900, near Guayaguayare on the extreme southeast corner of the island. Petroleum was first exploited in 1908, when a well was brought in near Pitch Lake. At present, petroleum is produced only in the southern part of the island; 90 per cent of

the production comes from within 7 miles of Pitch Lake, and the remaining 10 per cent from the Barracpore field 15 miles east, the Guayaguayare field 45 miles east, and the Tabaquite field 30 miles northeast of Pitch Lake.

The production of petroleum in Trinidad is shown in the following table:

PRODUCTION OF PETROLEUM IN TRINIDAD ISLAND

(in U. S. barrels)

1908	.	169	1916	.	.	928,581
1909	.	57,143	1917	.	...	1,602,312
1910	.	142,857	1918	.	.	2,082,068
1911	.	285,307	1919	.	.	2,780,000
1912	.	436,805	1920	.	.	2,083,027
1913	.	503,616	1921	.	.	2,354,000
1914	.	643,533	1922	.	.	2,500,000 (estimated)
1915	.	750,000				

PITCH LAKE DISTRICT

General Statement.—The Trinidad Pitch Lake covers 120 acres, about half a mile from the Gulf of Paria and 27 miles south of Port of Spain. There are five individual pools within the district, Brighton, Lot One, Parry Lands, Point Fostin, and Fyzabad. Barracpore and Guayaguayare are also included in this district, because they are only 15 and 45 miles, respectively, east of Pitch Lake and are in every way similar to the other pools. The oil accumulates in anticlinal folds on the flanks of the major syncline of southern Trinidad; there are three horizons favorable to the accumulation of oil in the island.

Development and Production.—The standard method of drilling was first used, but of late the rotary system has proven more successful. Considerable trouble is encountered in going through tar sands and shales, also in the danger from the strong gas pressure in the sand. Most of the wells are less than 2000 ft. deep, and many are between 500 and 1000. After gushing for a few days the wells usually settle down to small production. During the first year this production is temporarily increased by

spasmodic flows, aided by bailing or casing agitation, but few wells produce more than 100 barrels per day after the first year. Later they are pumped, and many cease producing after two or three years, although a few last more than eight years. During the first two years or more, wells must be cleared out frequently, because of sand.

The Pitch Lake crude has a gravity of 25.2° Bé. (0.902 sp. gr.) and contains 13 per cent gasoline, 40 per cent kerosene, 39 per cent lubricating oils, and 7 per cent fuel oil.

Four pipe lines lead from the Morne L'Enfer Forest Reserve to different points along the coast: one, 6 miles long, to a tank farm at Brighton near Pitch Lake, where there are terminal facilities capable of loading up to 35,000 barrels a day; one, 28 miles long, to the tank farm and sea loading station at Pointe à Pierre, with a branch to Barracopore field; one, 6 miles long, to Point Fortin where there is a topping plant and small loading facilities; and one, 2 miles long, to Guapo Bay for loading sail boats. The refineries and topping plants at Pointe à Pierre, Brighton, and Point Fortin take care of the oil produced in the district and have a total storage capacity of 180,000 barrels.

TABAQUITE FIELD

General Statement.—The Tabaquite field is located in Narvia County, 4 miles southeast of Tabaquite railroad station and 30 miles northeast of Pitch Lake; it is situated on the main anticline running from Pointe à Pierre to Nariva swamp, in the Tertiary below the Morne L'Enfer formation.

Development and Production.—The production of wells in the Tabaquite field is relatively small. The oil is of mixed paraffin and asphalt base with exceptionally high gravity, ranging up to 45° Bé. (0.80 sp. gr.), and contains from 30 to 40 per cent gasoline and the same amount of kerosene. A 3-inch pipe line connects Tabaquite field with a loading pier at Clartons Bay near Pointe à Pierre. There is a refinery at Tabaquite producing gasoline, kerosene, and fuel oil.

PROSPECTIVE FIELDS

Trinidad is crossed by an east-west fault from Port of Spain to Matura. North of the fault, the country is underlain by metamorphics, while to the south it is underlain by Tertiary and Cretaceous sediments. Two main folds cross southern Trinidad, an anticline from Pointe à Pierre to Nariva swamp running along the southern side of the Central Range, and a syncline from San Fernando to Mayara Point. Most of the present production comes from anticlinal folds within the major syncline, and there is strong possibility that further favorable structures will be discovered. The same statement applies to the Nariva anticline, the zone crossed by the Pointe à Pierre.

PETROLEUM LEGISLATION

Oil lands are classified as Freehold, or privately owned, and Leasehold, or State-owned. The oil rights to all Government lands have been acquired by British concerns by grants, but there are some private lands still available for exploration and exploitation.

The petroleum legislation of Trinidad conforms with the policy of the British Empire that aliens be excluded from the control of the petroleum supplies of the Empire. Under the Aliens Ordinance of 1921, both individual aliens and companies controlled by them, except citizens of a foreign state who hold land by right of treaty, may not hold more than 5 acres of land on an annual tenancy. The Governor may, however, issue a license to hold land as owner or tenant or mortgagee, for any estate or interest.

Drilling, operating, and abandoning oil wells, constructing, altering, and operating refineries, and transporting, storing, and refining oil are subject to regulations made by the Governor. The State has the right of pre-emption of all crude oil and oil products at a price to be agreed upon.

VENEZUELA

INTRODUCTION

The Republic of Venezuela is situated in the northern part of South America, between Colombia and British Guiana. It has an area of about 398,000 square miles, and a population of 2,500,000, with a density of 6 per square mile. Transportation and communication facilities include 600 miles of railroad, 700 miles of wagon roads, 11,000 miles of navigable waterways, and 18,000 miles of telegraph and telephone lines.

Venezuela has been an independent autonomous nation since its separation from Colombia in 1830. It has a federal system of government modeled after that of the United States of America. The President is elected for a term of seven years and is eligible for re-election. Government revenues slightly exceed expenditures; the National Debt is estimated at \$41,000,000, or \$8.40 per capita.

Agriculture is the main industry, and coffee the chief product. Venezuela is the third largest coffee producer in the world, and the second producer of high-grade coffee. The exports, in order of their importance, are coffee, cocoa, and hides. The United States furnishes about 50 per cent of the imports, and purchases about 40 per cent of the exports. The balance of trade is in Venezuela's favor.

PETROLEUM RESOURCES

PRODUCING FIELDS

The earliest production of oil in Venezuela was obtained from shallow wells, bored in the Municipality of Rubio, Tachira, by a national company under a concession granted the 3d of Sep-

tember, 1878. Oil from the wells was refined by crude methods and the products, kerosene and fuel oil, were sold in local market. Commercial production, however, was not obtained until 1914, when the first producing well in the Mene Grande field came in.

At present there is only one commercially producing field in Venezuela, Mene Grande, located on the foothills bordering Lake Maracaibo, about 10 miles inland and 90 miles southeast of the city of Maracaibo. About 25 miles in this field may be considered proven territory.

The Pauji shale, middle Tertiary, is the probable oil source and reservoir in the Mene Grande field, and is about 3000 ft. thick. The oil is found in loose sands near the top and bottom of the formation. Considerable production trouble has been encountered, on account of the unconsolidated nature of the oil sands, which choke the wells and cut the valves. Structurally speaking, the Mene Grande field is part of the south plunging Misoa anticline, which in turn is more or less parallel with the line of uplift of the mountains immediately to the east. The outcrop of the oil sands makes one of the largest oil seepages in the world, and the asphalt-impregnated ground covers about 500 acres.

The first well was drilled with a Star rig to a depth of 390 ft., the others were drilled with standard tools; since that time a combination of the standard and rotary has been used. Some of the Mene Grande wells came in as big gushers, but sanded up and settled down to a production of a few hundred barrels per day. The export statistics do not give a true idea of the potential productivity of the wells.

That other areas in the Maracaibo Basin are capable of large production is shown by the coming in, on the 15th of December, 1922, of a large producing well, about one mile from the eastern shores of the Lake and northwest of the Mene Grande field; this well flowed uncontrolled until, after yielding many thousands of barrels, it sanded up. Another important event was the completion of the well at La Paz, about 30 miles west of Maracaibo.

The production of the Mene Grande field, which to date represents the total from Venezuela, is shown in the following table:

PRODUCTION OF PETROLEUM IN VENEZUELA

(in U. S. barrels)

1917	119,804	1920.....	456,523
1918	317,130	1921.....	1,443,834
1919.....	301,425	1922... . .	2,500,000 (estimated)

The oil has an average gravity of 18° Bé. (0.946 sp. gr.), and contains 6 per cent gasoline, 9 per cent kerosene, and 85 per cent fuel oil.

A pipe line, with branches to the producing wells, serves to transport the oil from Mene Grande to the refinery and loading terminal at San Lorenzo on Lake Maracaibo. There are six 55,000-barrel tanks at San Lorenzo and two at Mene Grande, where there is also a refinery with a daily capacity of 2000 barrels—the only one operating in Venezuela. Mene Grande crude is used for the operation of the company's refinery at Curaçao and is now being shipped to Atlantic ports in the United States.

PROSPECTIVE FIELDS

Oil indications of varied importance are found in many localities in Venezuela.

The Falcon State region includes the entire State of Falcon and part of Yaracny. The same formations found in the Maracaibo Lake Basin are found in this region, except that here they are distinctly marine in their origin. Oil seepages are found in Miranda, Democracia, and Buchivacoa, in Falcon, in a bend parallel with the coast of the Gulf of Maracaibo.

Oil seepages in sands of Eocene age are found in the Peninsula of Araya and in the Islands of Cubaqua and Margarita. In the State of Monagas a black, Cretaceous oil shale is found overlying a series of limestones and oil-bearing sandstones. Oil seepages are found in the region of Punceres, Chaguaramal, and Quiriquire, while oil and mud volcanoes are found about 10 miles southeast of Maturinas well, at Guanipa, Pedernales, and other places in the flats of the Delta of the Orinoco. Asphalt has been exported from the Guanoco Lake, 20 miles from the Gulf of Paria, for many years.

About 22,000 tons were exported in 1922. The eastern Venezuela fields are within a short distance of deep water transportation; the undeveloped character of the country, however, makes it more difficult to bring in machinery and supplies than in the western part.

The broad basin of the Orinoco River may be divided into two parts, the Guiana, underlain by igneous or metamorphic rocks and therefore impossible oil territory, and the Llanos, mostly underlain by sediments with possible oil-bearing formations. The Guiana is the land block between the river and the British frontier. There are some oil seepages in the eastern foothills of the Andes, indicating that possibly the formations found in the Maracaibo Lake Basin extended eastward into the present Orinoco Valley before the uplift of the Venezuelan Andes.

PETROLEUM LEGISLATION

The petroleum law of the 9th of June, 1922, provides that everything related to the exploration and exploitation of petroleum is a "Public Utility."

The right to explore, exploit, manufacture, refine, and transport petroleum may be obtained by a concession from the Government, by any person or company legally domiciled in the country.

Exploration rights are limited to an area not exceeding 10,000 hectares, in blocks of 500 hectares each and to a period of three years, subject to an exploration tax of 10 centimes of a bolivar per hectare. The maximum total area retained for exploitation is one-half of the original exploration area; the remainder reverts to the Government for National Reserves.

Exploitation rights may then be acquired for a term of forty years, covering areas of 500 hectares each. An initial payment of 2 bolivars per hectare for the first three years, 4 bolivars per hectare for the next twenty-seven years, and 5 bolivars for the remaining ten years must be paid. A royalty of 10 per cent of the production at the well, or its value at the shipping port, must be paid to the State. If the land is located 250 kilometers from

the coast or Lake Maracaibo, or on the east side of the Andes, the royalty and the price per ton will be reduced to $7\frac{1}{2}$ per cent or $1\frac{1}{2}$ bolivars per ton, respectively, and rentals to 50 per cent of the above-mentioned amounts.

Refineries or manufacturing plants must pay, on Venezuelan products sold for consumption in the country, an amount equal to 50 per cent of the import duties for similar foreign products. Such companies pay no additional taxes for the refined products of their own oils, but they pay a tax of $2\frac{1}{2}$ per cent on the gross income from products of oils produced by other companies. Transportation companies must pay $2\frac{1}{2}$ per cent of the gross income derived from transporting oil produced by other companies.

Concessions may be transferred, upon notifying the Chief Executive. Concessionaires have the right to import, free of duty, all machinery and supplies for their work, as well as for the sanitation of the fields. Pipe lines are considered common carriers. There are no drilling obligations.

ARGENTINA

INTRODUCTION

The Argentine Republic is the second largest South American country, with an area of 1,150,000 square miles, extending from the Andes Mountains to the Atlantic Ocean. The region from the foothills of the Andes to the coast is a gradually sloping plain, of great fertility. The climate is temperate, except in the extreme northern part where tropical weather prevails. The population numbers about 8,700,000, with a density of seven and one-half per square mile, Italians and Spaniards predominating. Spanish is the official language. The railroad development of Argentina ranks next to that of the United States and Canada in the western hemisphere, and ninth in the world; there are about 22,500 miles of railroad, of which the Trans-Andine Railroad, connecting Buenos Aires with Santiago, Chile, is the most important.

Argentina proclaimed its independence of Spain in 1816, but a stable republican government was not established until 1853. The President, who is elected for six years, may not succeed himself. Except for the duration of the Great War, the Argentine Government has had a balanced budget. During the war period, revenues fell below normal because of poor trade conditions. The National Debt is estimated at \$760,000,000.

Argentina leads all South American countries in foreign trade. Great Britain and the United States control the bulk of this, with France and Spain next in importance. The chief exports, in order of their importance, are live-stock products, wheat, maize, and oats; textiles, foodstuffs, iron, and crockery are the chief imports. Agriculture and cattle-raising are the leading industries.

PETROLEUM RESOURCES

PRODUCING FIELDS

The commercially productive oil region of Argentina is confined to the Comodoro Rivadavia field, situated along the coast

about 980 miles south of Buenos Aires in the territory of Chebut. This field was accidentally discovered in 1907, while the discoverers were drilling for water, and immediately the Government reserved 5000 acres surrounding the well. It is within this Government reservation that the greatest part of the successful development has taken place to date. The formations involved in the geology of the Rivadavia field are sediments of late Tertiary and Cretaceous age, consisting of sandstones, clays, and tuffaceous deposits; the oil occurs in unconsolidated sands, probably of the Upper Cretaceous. The field is developed along a flat monocline, with general inclination of about 12 ft. per mile, where the change of dip allows for the accumulation.

It is estimated that there are at present over 100 producing wells in the Rivadavia fields, practically all located on the Government reservation. The wells have an average depth of about 1800 ft., and the number of dry holes in the proven area has been remarkably small. The wells come in with high flush productions, which rapidly decrease during the first month, after which they yield a small volume by pumping. In 1921, a large flowing well came in, at the rate of 20,000 barrels per day; but this production soon declined. Considerable gas accompanies the oil, but it has been impracticable to utilize it commercially on a large scale. Considerable water accompanies the oil in some wells. The wells on the Government reservation, from 1907 to the end of 1922, produced practically the entire yield of the field, or about 11,000,000 barrels.

The production of the field is shown in the following table:

PRODUCTION OF PETROLEUM IN ARGENTINA
(in U. S. barrels)

1907. . . .	101	1915	516,120
1908. . . .	11,472	1916	796,920
1909	18,431	1917.	1,144,737
1910	20,753	1918.	1,321,315
1911.	13,119	1919	1,504,300
1912.	47,007	1920.	1,366,926
1913.	130,618	1921.	1,747,410
1914.	275,500	1922.	2,100,000 (estimated)

The Rivadavia product is a dark, viscous crude with a gravity of 23° Bé. (0.915 sp. gr.), containing 3 per cent gasoline, 10 per cent kerosene, and 87 per cent residuum used for fuel. At the Government topping plant at Rivadavia, about 10 per cent of light oils are recovered, and the balance is used for fuel.

The field is situated within 5 miles of the coast, and the oil is piped to the loading wharf, whence it is shipped by tank steamers to Buenos Aires. The nearest main line railroad is 500 miles distant from the field, and there is no pipe line or railroad connection with this point. There are storage tanks at Rivadavia, Buenos Aires, and Bahia Blanca; and additional facilities are being installed at these points. The Argentine Government owns and operates a small topping plant at Comodoro Rivadavia, which is being enlarged, and plans are under way for other plants at Buenos Aires.

The production is utilized as fuel for the Navy, for the Government railways, and for supplying the needs of the Government departments and enterprises at Buenos Aires. Private concerns are also supplied with oil.

PROSPECTIVE FIELDS

There are three well-defined prospective regions in the Republic: along the eastern foothills of the Patagonian Cordillera, in the territory of Nequen and the southern part of Mendoza, about 650 miles southwest of Buenos Aires; the Caceuta District in the Province of Mendoza between Barro Negro and Yavi Chico; and the zone that lies along the Andean foothills, crossing from Bolivia into the Provinces of Salta and Jujuy, about 900 miles northwest of Buenos Aires.

Oil indications are reported in the Province of Buenos Aires, at Bahia Blanca and Mar del Plata. Some drilling has been done at Nequen and Jujuy, with encouraging results. The Jujuy field is developed in dolomites and conglomerates of lower Cretaceous and sandstones and dolomites of Jurassic, and the Nequen in

shales and sandstones of upper Jurassic. The structure in these two fields appears as well-defined anticlines.

PETROLEUM LEGISLATION

According to the law of the 17th of November, 1917, which reformed the Mining Code of 1886, the subsoil belongs to the State, and surface owners have no priority rights. The oil industry is considered in the nature of a public utility, and there are no restrictions against foreigners in the development of the oil resources. Exploration and exploitation on private lands is subject to the consent of the owners, if the property is improved, and to the payment of damages.

Exploration of lands can only be carried on by virtue of written permits from the *Direccion General de Minas, Geologia e Hidrologia*, which, when granted, are exclusive, limited to a period of one hundred and forty to three hundred days, and to an area of 500 to 2000 hectares. An initial payment of \$2 for each claim of 500 hectares is necessary. The location and ground to be covered must be designated, and exploration work must begin within thirty days of the date of the permit.

Test-drilling concessions are granted by the Federal Government, after a request for permission to begin formal work has been made. These concessions are limited to a period of fifteen months, with the privilege of extension, and to an area of three to seven claims, of 81 hectares each. Tax exemption, while test-drilling continues, runs for three years. After the third year, a tax of 100 pesos a year must be paid for each claim. The area selected for the test-drilling must be surveyed within a given time, and, in addition to the survey expenditures, from 10,000 to 40,000 pesos must be spent upon actual work.

A title to the subsoil is obtainable only upon actual discovery of oil and, when obtained, it may be transferred or sold.

BRITISH BORNEO

INTRODUCTION

The Island of Borneo is divided into a British and a Dutch possession; British Borneo occupies the northern part of the island and includes British North Borneo proper, Brunei, and Sarawak. It has an area of 77,000 square miles and a population estimated at 930,000, consisting mainly of Mohammedan and Chinese settlers along the coast and of aboriginal tribes living farther inland. Transportation facilities include a railway, 127 miles long, from Jesselton, on Gaya Bay, to Menalap, in the interior, and a branch from Beaufort to Weston on Brunei Bay.

North Borneo is under the jurisdiction of the British North Borneo Company and is administered by a Resident Governor and a Court of Directors in London. Brunei and Sarawak are independent states under the protection of Great Britain. North Borneo and Sarawak have no foreign or domestic debt, but the debt of Brunei is estimated at \$250,000.

Timber is the territory's greatest resource and chief export; sago flour, rubber, cutch (mangrove product), coal, and petroleum are also important exports. Rice, tobacco, and cotton goods are imported. Practically all of the foreign trade goes through Singapore.

PETROLEUM RESOURCES

PRODUCING FIELDS

The producing district of British Borneo, which has of late greatly increased in importance, is located at Miri on the west coast of Sarawak. The oil is found in upper Tertiary sedimentary

rocks, which lie near the coast, surrounding crystalline schists which form the backbone of the island.

The development of the oil fields of Sarawak began in 1911, when about 1200 barrels were produced; production steadily increased until 1921, when it reached 1,410,000 barrels.

The production of British Borneo is shown in the following table:

PRODUCTION OF PETROLEUM IN BRITISH BORNEO
(in U. S. barrels)

1911	.	1,200	1917.	..	530,000
1912		40,000	1918.		495,000
1913		140,000	1919		590,000
1914	..	310,000	1920		1,030,000
1915	. .	385,000	1921..	.	1,410,000
1916.	...	625,000	1922	...	1,500,000(estimated)

The crude has a gravity of 18.3° B₆. (0.944 sp. gr.), and contains 9 per cent gasoline, 26 per cent kerosene, and 65 per cent lubricating oils.

There is a refinery, tank storage, and two 8-in. submarine pipe lines at Lutong.

PROSPECTIVE FIELDS

Important indications of petroleum are found near Abai, in the northern part of British North Borneo, and along the shores of Brunei Bay in Brunei, about 150 miles north of the Sarawak fields.

PETROLEUM LEGISLATION

In North Borneo and Sarawak, no nationality restrictions are imposed on prospecting and mining by foreigners. In Brunei, there are no restrictions on private lands, but Government lands are restricted to British subjects.

The British Borneo Petroleum Syndicate has a concession extending to July, 1930, to develop the petroleum resources of the entire 30,000 square miles of North Borneo and 150 square miles in Brunei.

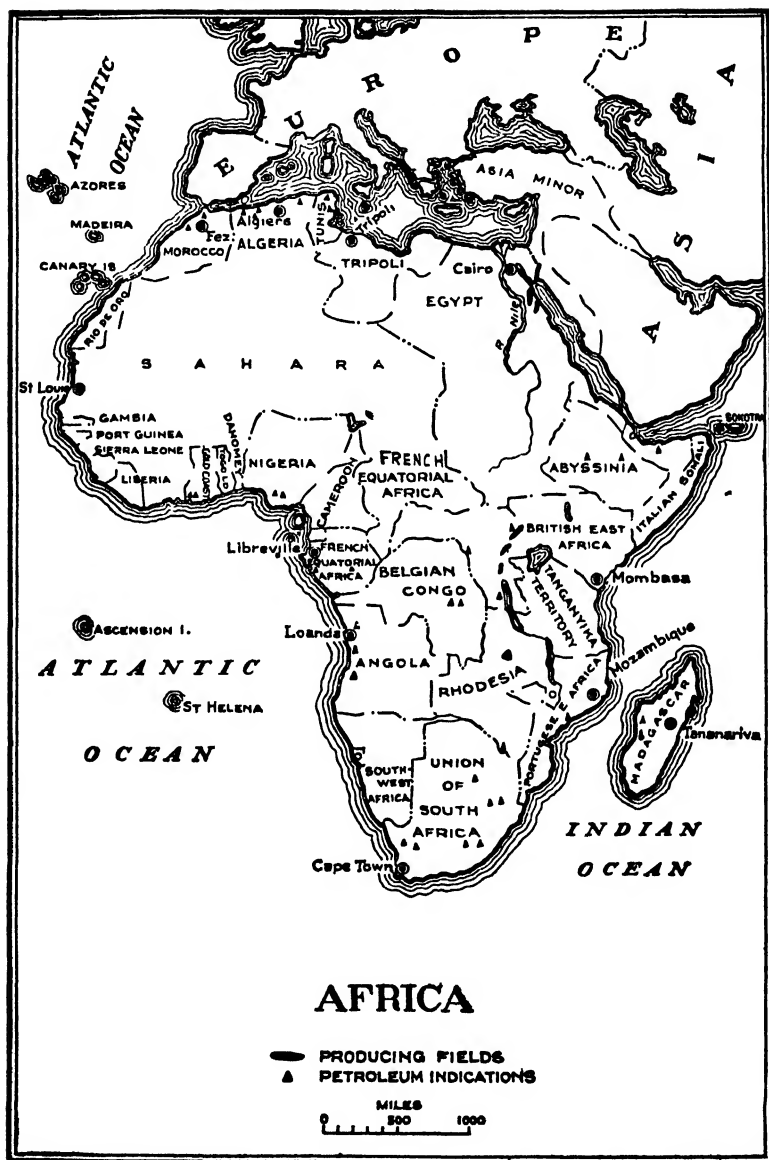
EGYPT

INTRODUCTION

The Kingdom of Egypt, bordering on the Mediterranean and Red Seas, is situated in northeastern Africa and extends to the Sahara Desert on the west. It covers an area of about 350,000 square miles and has a population of about 12,750,000, of which 90 per cent are Egyptians and the rest foreigners, principally British. Egyptian is the language of the country, but English is generally spoken. The general appearance of the land is remarkably uniform; the river Nile drains a fertile valley covering about 12,000,000 square miles. Transportation is facilitated by about 2000 miles of railroads and the navigable waterway of the Nile. The city of Cairo, on the Nile, is connected with the Palestine railway system by a swing bridge over the Suez Canal, at Kantara. The telegraph and telephone lines, belonging to the Government, have a total length of 8500 miles. Camel caravans are used for overland transportation in the interior.

In February, 1922, England recognized Egypt as an independent state, but retained certain rights in regard to communications and development. Under the new Government, executive power is vested in the King, and legislative power in a Parliament of two houses, elected by the people. Until 1921, the Egyptian Government had a balanced budget, but, since that date, there has been a deficit. The National Debt is estimated at \$461,000,000.

Agricultural products are the country's main resources; three crops are raised annually; the most important are cotton, wheat, and barley. Petroleum is the chief mineral product. Great Britain, the United States, and France control the foreign trade of



Egypt. The chief exports, in order of their importance, are raw cotton, cereals, and tobacco; the chief imports are textiles, coal, lumber, and metals.

PETROLEUM RESOURCES

PRODUCING FIELDS

The two producing fields in Egypt are located on the western coast of the Red Sea, about 250 miles south of the Suez Canal. The Gernsah field lies near the confluence of the Gulf of Suez and the Red Sea, and the Hurghada field lies 35 miles farther south, opposite the Island of Jaffatine. The oil in the Gernsah field occurs in an anticline developed in Miocene strata, and at Hurghada in a quaquaversal structure in the Cretaceous. Gypsum, salt, and dolomitic limestone are associated with the accumulation of oil in both fields.

The Gernsah field was discovered in 1911, and attained its maximum production in 1914, when about 600,000 barrels were produced. It has declined rapidly since then, and at present, of the 22 wells which were drilled, only about 6 are producing, with a total of about 50,000 barrels per year.

The Hurghada field was discovered in 1914, and attained its maximum yield in 1918, when about 2,000,000 barrels were produced. Forty-four wells have been drilled, but at present there are only about 22 producing, with a total of about 1,000,000 barrels per year.

The production from the older field, owing to the irregularity of the formations, is very uncertain; and the sanding-up of the wells causes considerable trouble. The formation in Hurghada is more regular, and the wells are larger producers; but the incursion of salt water and the subsequent formation of emulsion have greatly hindered successful operation. A serious obstacle to operations is the absence of fresh water in the region.

The production of the Egyptian fields is shown in the following table:

PRODUCTION OF PETROLEUM IN EGYPT
(in U. S. barrels)

	GEMSAH	HURGHADA	TOTAL
1911	9,150	. . . . .	9,150
1912	205,905	.....	205,905
1913	94,635	.....	94,635
1914	698,338	78,700	777,038
1915	130,608	131,600	262,208
1916	160,000	251,000	411,000
1917	152,750	856,000	1,008,750
1918	244,750	1,835,000	2,079,750
1919	58,184	1,604,000	1,662,184
1920	49,000	993,000	1,042,000
1921	50,000	1,205,000	1,255,000
1922	50,000	1,150,000	1,200,000 (estimated)

The crude has a gravity of 22° Bé. (0.921 sp. gr.), and contains 8 per cent gasoline, 14 per cent kerosene, 12 per cent gas oil, 24 per cent lubricating oils, 22 per cent fuel oil, 10 per cent asphalt, and 8 per cent paraffin.

There are storage tanks at Suez, Hurghada, and Gernsah, with a total capacity of about 1,000,000 barrels. The refinery at Suez, with a capacity of about 7000 barrels per day, handles the product of these fields, as well as foreign oil. Gasoline, kerosene, and fuel oil are the products of the refinery.

PROSPECTIVE FIELDS

Oil indications are known to exist at many places in the general region where the present producing fields are located, and in the Sinai Peninsula. The Egyptian Government is now prospecting at Abou Chaar, near Hurghada, and at Abou Dibba.

PETROLEUM LEGISLATION

Exploration and exploitation licenses are issued by the Government, for limited areas, and provide for the payment of a royalty of 12½ to 25 per cent of the production.

The Egyptian Government is associated with the Anglo-Egyptian Oil Company in the exploitation of the present fields, and participates to a small extent in the profits. The company has been making efforts for some time to obtain additional acreage from the Government, to extend the exploitation.

COLOMBIA

INTRODUCTION

The Republic of Colombia, in the northwestern part of South America, has an area of about 460,000 square miles, and a population estimated at 6,000,000, with a density of 13 per square mile. White, Indian, and negro races each represent 10 per cent of the population, and mixed races the remaining 70 per cent. Spanish is the official language. The climate along the Pacific Coast, and in the Magdalena Valley, is extremely hot, with constant rains; in the higher levels of the Cauca and Atrato Valleys, and in the plateaus, there are two rainy seasons, extending from April to June and from October to December. Lack of transportation facilities is Colombia's greatest drawback. The Magdalena River is the main artery of the country and is navigable for about 900 miles, but there are no navigable rivers flowing into the Pacific. The total railroad length is estimated at 800 miles, that of wagon roads at 250 miles, and that of telegraph lines, which are owned and operated by the Government, at 13,000 miles. Much of the inland transportation is effected by pack mules and Indians.

The country gained its independence from Spain in 1819, but the Government did not assume its present form until 1886. The President, who is elected for four years, cannot succeed himself. The Catholic Church has a marked influence on the national life of the country. As a rule, the Government has an annual deficit; the National Debt is estimated at \$42,000,000.

Colombia is the second largest coffee producer in the world, and the first producer of high-grade coffee. It stands second in the production of platinum, and first in the production of emeralds. Exports aggregate about \$60,000,000 and include the foregoing

products, hides, and bananas. The chief imports are cotton goods, metals, foodstuffs, and drugs. The foreign trade, except during the Great War, has shown a steady increase, with the balance of trade in Colombia's favor. The bulk of the trade, both export and import, is controlled by the United States.

PETROLEUM RESOURCES

PRODUCING FIELDS

Although, for many years, drilling for oil had taken place at different localities in Colombia, it was not until 1918 that the first commercial wells were brought in at Barranca Bermeja, on the Magdalena River. At present, the only producing field is Las Infantas, located in the De Mares Concession, which lies between the Sagamosa, Sarare, and Magdalena Rivers, in the Department of Santandar. The oil accumulates in an anticline, in a series of sandstones and shales with interbedded coal beds of Eocene age. This series overlies the black bituminous shales and limestones of the Upper Cretaceous, which are taken by many to be the source of oil.

Three producing wells have been drilled at Las Infantas, near the junction of the Oponcito and Colorado Rivers, with depths of 1700, 1900, and 2300 ft., respectively, and a combined production estimated at 8000 to 15,000 barrels per day. The net monthly yield of the field during 1922 was close to 10,000 barrels.

Las Infantas crude has a gravity of 36° Bé. (0.843 sp. gr.), and is reported to contain 60 per cent gasoline, 6 per cent kerosene, 20 per cent lubricating oils, and 12 per cent asphalt.

The main headquarters of the operation are located at Barranca Bermeja on the Magdalena River, 25 miles west of Las Infantas, and are connected with it by a 6-in. pipe line. The oil is refined at Barranca Bermeja, where a refinery, with a daily capacity of 2000 barrels, is located; storage capacity is close to 500,000 barrels. The first refined products were put on the Colombian market in May, 1922.

PROSPECTIVE FIELDS

There are five main prospective oil districts in Colombia: the Caribbean Coast District; the Pacific District; the Magdalena River Basin, containing the producing field at Las Infantas; the Catatumbo River Basin; and the Orinoco-Amazon District.

The Caribbean Coast District covers all the prospective fields within 50 miles of the coast, and the basins of the Sinu and Atrato Rivers, where a series of parallel north-south prospective fields, marked by mud volcanoes and gas and oil seepages near the crest, is found. The formations range in age from Cretaceous to Recent. The wells that have been drilled in the Sinu Valley have discovered no commercial deposits of oil. Mud volcanoes in the vicinity of Perdices, 6 miles southwest of Puerto, and at Turbaco, on the Cartegena-Calamar Railroad, led to the drilling of eight wells at the former and six at the latter places, without encouraging results.

In the Pacific Coast District, seepages in the Coal Series are reported in the Departments of Choco and Valle, in the region of the Bando River, extending from Cali on the Cauca River to Quibdo, north of the Bando River.

The Magdalena River Basin includes the part of the Cauca Basin not underlain by igneous or metamorphic rocks. The sedimentaries in the basin range from Jurassic to Recent, with a possible oil horizon in the Coal Series (Eocene), and in the middle Tertiary. Seepages of oil are reported to exist on the west side of the Magdalena River at many places, from Guatagui on the Bogota-Girardot Railroad, passing through the Honda District and the Las Infantas field, to the Valley of the Casas River near Lake Zapatosa. A number of wells were drilled near the Lebrija River, north of the De Mares Concession, without commercial results.

In the Catatumbo River Basin, seepages of light and heavy gravity oil are found in the Coal Series, near the foothills at Rio de Oro, and in the hills southeast of Tres Bocas. The anticlinal folds follow, in a general way, the direction of the Perija range,

and extend into Venezuela, where oil with a gravity of 31° Bé. (0.86 sp. gr.) has been encountered. This region is practically all covered by the Barco Concession, controlled by American interests.

In the Orinoco-Amazon Basin, seepages have been reported near the junction of the Putamaiyo and Guamuez Rivers (Amazon drainage), and in the Meta Valley (Orinoco drainage); but these reports are unconfirmed, and the region is so far from practical transportation that the prospects will be unimportant for many years.

PETROLEUM LEGISLATION

According to the law of the 31st of January, 1923, subsoil rights are vested in the State unless the land was acquired prior to the 28th of October, 1874, in which instance it is vested in the private landowner. The Government reserves the subsoil right to all public lands.

Surface exploration is free; subsoil exploration requires a permit issued for a maximum term of five years.

After the explorer has discovered oil, he may obtain from the Government an exploitation permit, which runs for twenty years with the privilege of renewal, and covers an area of not less than 1000 hectares nor more than 15,000 hectares in any one department. An annual rental of 10 cents per hectare and a royalty of 6 to 10 per cent of production, according to the zone, must be paid to the State.

Private lands cannot be exploited without notifying the Government. The royalties are the same as for public lands, but there is no surface rental paid to the State.

An export tax of 1 to 6 per cent must be paid on asphalt.

MISCELLANEOUS PRODUCING FIELDS

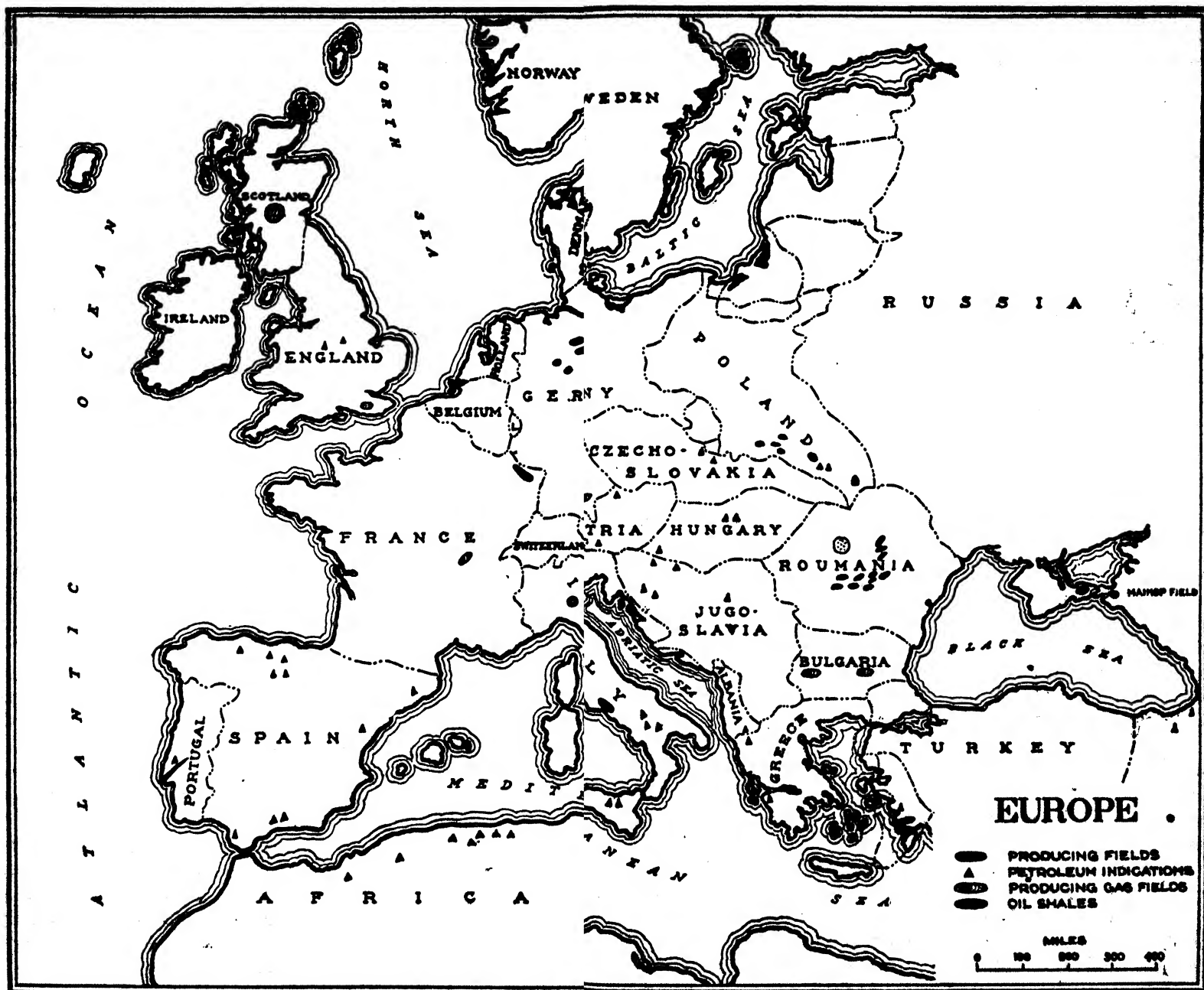
FRANCE

INTRODUCTION

France is situated in the western part of Europe, between the Atlantic and the Mediterranean; the Pyrenees Mountains separate it from Spain; the Alps, Jura, and Vosges Mountains from Italy, Switzerland, and Germany. It has an area of 212,000 square miles and a population of about 39,500,000, or 186 per square mile. Transportation and communication facilities include about 24,000 miles of national roads, 700 miles of navigable rivers and canals, 25,000 miles of railroads, and 160,000 miles of telegraph and telephone lines.

Since the overthrow of Napoleon III, in 1870, France has had a republican form of government, with executive power vested in a President, who is elected for seven years, and with legislative power vested in the Senate and Chamber of Deputies. Since the War, Government expenditures have exceeded revenues; the budget deficit for 1922 is estimated at \$309,000,000. The National Debt is about \$51,000,000,000.

Agriculture is the main industry, with cereals, mulberry trees for silk culture, grapes for the wine industry, and fruit, as the chief products. The exports, in order of their importance, are silk and cotton goods, clothing, automobiles, and chemicals; these go chiefly to Belgium, Great Britain, Germany, and the United States. Imports, chief of which are coal, cereals, wool, machinery, and raw cotton, come from the United States, Great Britain, Germany, and Belgium. The value of imports exceeds that of exports.



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PETROLEUM RESOURCES

PRODUCING FIELDS

Petroleum in commercial quantities is obtained from the Pechelbronn District, Department of Bas Rhin, in Alsace. The district is from 20 to 27 miles long, with a maximum width of 10 miles. The wells are among the oldest in the world, and are located north of Strasburg, at Durrenbach, Lobsan, Schwabweiler, Biblisheim, Sulz, Walburg, Schweighausen, and Altkirch.

The oldest rocks are Jurassic, overlain by upper Eocene non-fossiliferous conglomerates, upon which lie the extensive thick marl beds of the lower Oligocene, the most productive oil-bearing formation of the region. The oil is confined almost exclusively to lens-shaped sands or marl beds where fresh water and marine strata alternate. The oil field is in the great fault trough of the upper Rhine Valley; the oil lies in the disturbed area on the down-thrown side, and is influenced by faults and sandy lenses in the marl beds, rather than by folds.

Oil was first obtained from shallow pits, by washing the sand with hot water. About 1875, this method was replaced by that of digging underground galleries. These galleries run for 700 ft. in length, at a depth of about 720 ft. below the surface of the earth. At present, modern drilling machines are operated by steam or electricity. About 2200 wells, varying in depth between 1000 and 1200 ft., have been drilled, but at present only about 500 are producing, with a total of about 1000 barrels per day.

The production of the fields has averaged about 300,000 barrels a year, since 1920, when they reverted to the French Government after the Great War. About 60 per cent of this production is from wells, while the other 40 per cent comes from the old mines.

The Pechelbronn crude has a gravity of 29° Bé. (0.88 sp. gr.), and contains 4 per cent gasoline, 20 per cent kerosene, 19 per cent gas oil, 45 per cent lubricating oils, and 6 per cent fuel oil.

All the fields have pipe lines, and there is one 6-in. line from Pechelbronn to Kutzenhausen. The most important refinery,

with a yearly capacity of 450,000 barrels, is at Pechelbronn; two smaller ones are located at Biblisheim and Durrenbach. There are also asphalt works at Lobsam and Pechelbronn. The oil produced in this district supplies only a very small part of the home consumption; France depends for her supply on the United States, Roumania, Mexico, and Russia.

PROSPECTIVE FIELDS

Oil shales have been exploited at Autun and Allier, in the central part of France; there are also minor deposits of oil shales in the Pas-de-Calais region. Asphalt is found in the eastern Jura Mountains in the department of Ain, and in the western Jura Mountains near Amberieu. Oil indications are also found at Puy-de-Dome, Gard, Herault, and along the northern flanks of the Pyrenees.

PETROLEUM LEGISLATION

French mining legislation does not apply strictly to petroleum. Under the Mining Code of April, 1810, the owner of the soil has the right to start exploration without any formalities. Consent of the owner is required for prospecting on his lands, but if it is refused the Bureau of Mines will grant the authorization. Exploring companies must be organized under the French Law.

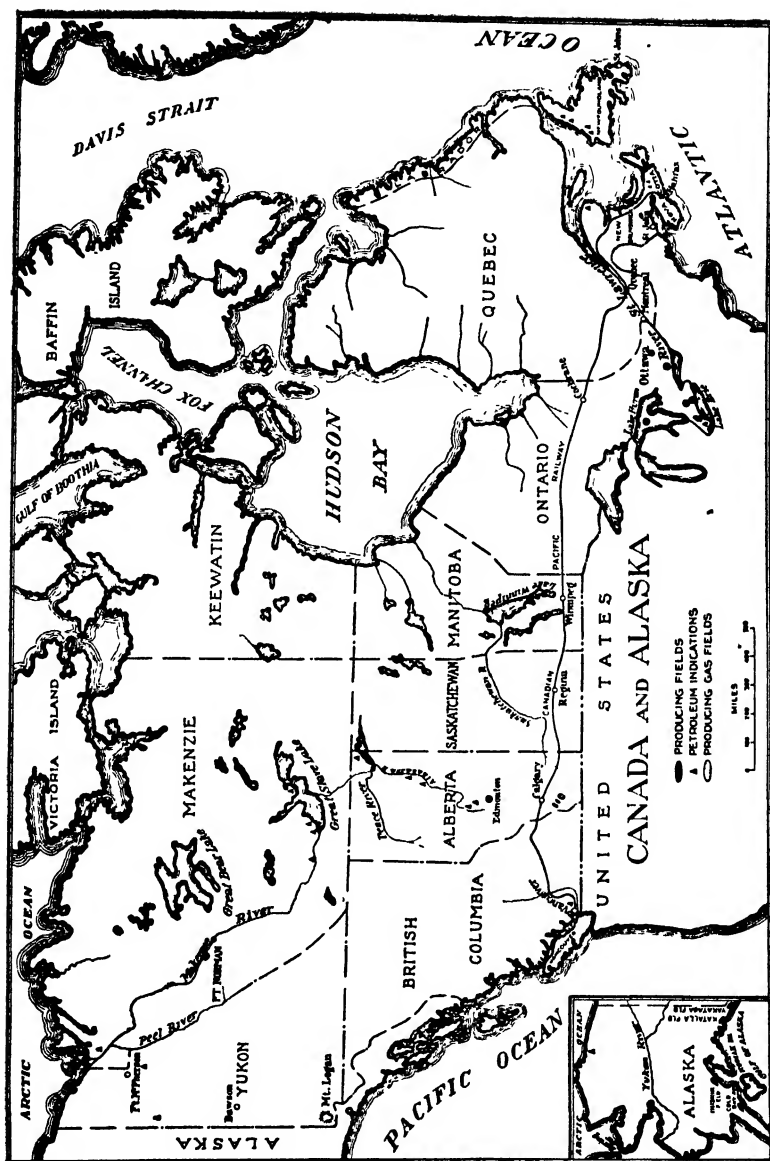
No exploitation work can be started on a mine until a concession has been granted by the Government. The producer is the owner of the subsoil for the duration of the concession, and the subsoil becomes a property within a property. Royalties are in proportion to production, and are figured each year on the basis of 6 per cent of the net profits.

A proposed law, which has been approved by the Legislature, contains the following reforms:

Government authorizations granted after the landowner has refused them are considered exclusive licenses, and entitle the explorer to take possession of the land upon the deposit of a

bond and payment of a tax of 5 francs per hectare. Before the definite concession has been granted, the producer may dispose of all products obtained.

The Government reserves the right to determine, in each separate instance, the size and location of the exploitation area, although it places practically no limit upon the area to be explored.



CANADA

INTRODUCTION

The Dominion of Canada lies north of the United States; it is the largest of the British possessions, with an area of about 3,700,000 square miles. It has a population estimated at 8,800,000. Transportation and communication facilities include 2700 miles of navigable lakes, rivers, and canals; 39,000 miles of railroad; and 50,000 miles of telegraph line.

The Dominion has a Federal Government, with a Governor appointed by the King of England and a Parliament elected by the people. For many years, it has maintained a surplus of revenues over expenditures. The National Debt is estimated at \$2,345,000,000.

The chief products of Canada are oats, wheat, and barley; wheat is also the country's main export, with lumber second in importance. Canada leads the world in the production of cobalt, asbestos, and nickel. The chief imports are iron and steel. About 65 per cent of the foreign trade is carried on with the United States.

PETROLEUM RESOURCES

PRODUCING FIELDS

Petroleum is found in commercial quantities in the Province of Ontario, and in small amounts in Alberta and New Brunswick. Nearly all of the Ontario oil is found in Lambton and Middlesex Counties, between Lake Huron and Lake Erie. The oil occurs in Devonian limestone, and the largest pools are in well-defined domes, such as those at Petrolia, Oil Springs, Mosa, and Bothwell.

As early as 1859 attempts were made to utilize the oil in Lambton County, but it was not until 1862 that the real develop-

ment began, with a production of 11,775 barrels. Production steadily increased until a maximum of 913,498 barrels was reached in 1900; since that time the production has declined. Petrolia was the largest producing field in Canada until the development of the Mosa field. The Canadian system of drilling with stiff wooden rods is used in boring wells, usually to a depth of 200 to 550 ft.

The production of the Canadian fields since 1890 is shown in the following table:

PRODUCTION OF PETROLEUM IN CANADA

(in U. S. barrels)

1890.....	795,000	1907....	788,872
1891....	755,298	1908....	527,987
1892....	779,753	1909....	420,755
1893....	798,406	1910....	315,895
1894....	829,104	1911....	291,096
1895....	726,138	1912....	243,336
1896....	726,822	1913....	228,080
1897....	709,857	1914....	214,805
1898....	758,391	1915....	215,464
1899....	808,570	1916....	198,123
1900....	913,498	1917....	213,832
1901....	756,679	1918....	304,741
1902....	530,624	1919....	238,171
1903....	486,637	1920....	198,425
1904.....	552,575	1921....	190,000
1905....	634,095	1922....	200,000 (estimated)
1906....	569,753		

The Ontario crude has an average gravity of 33.1° Bé. (0.858 sp. gr.) and contains about 5 per cent gasoline, 42 per cent kerosene, 8 per cent gas oil, 25 per cent tar, and 10 per cent coke. It resembles closely the Lima-Indiana crude.

PROSPECTIVE FIELDS

There are oil possibilities in various regions of Canada, such as the Northwest Territory, Alberta, British Columbia, Saskatche-

wan, Manitoba, Nova Scotia, and New Brunswick. In the first-named area, oil was recently discovered at Fort Norman on the Mackenzie River, and at present other wells are being drilled in that district. Indications are also favorable along the foothill region of western Alberta, where beds of Devonian age are known to contain oil.

NATURAL GAS

Natural gas has been produced in Ontario, Quebec, New Brunswick, and southern Alberta for many years; Ontario is the most important producer. The natural gas industry began in 1885, when a well drilled for gas in Ontario yielded a flow of 50,000 cu. ft. per day. Since that time many wells have been drilled, and the gas has been piped to nearby Canadian cities and to Detroit and Buffalo in the United States. This industry is now controlled by American interests.

ATHABASKA TAR SANDS

Perhaps the most remarkable superficial deposit of petroleum-bearing rocks lies along the Athabaska River, north and south of its confluence with the Clear Water River. This deposit covers an area of about 2000 square miles. The so-called Athabaska Tar Sand Beds are from 50 to 175 ft. in thickness, with an overlay, 6 to 100 ft. deep, of loose soil. The series has been assigned to the Dakota period of the Cretaceous. Operations for the mining and treating of these sands on a commercial scale have not yet been undertaken, but it has been estimated that one acre of tar sands, with an average depth of 50 ft., contains 80,000 barrels of crude oil, carrying about 14 per cent gasoline, 45 per cent kerosene, and 36 per cent lubricating oils.

PETROLEUM LEGISLATION

The Canadian provinces have each developed different types of regulations of their oil resources. Some of the salient features of the various laws follow:

Ontario.—The right of exploration on lands reserved to the Crown, is obtained by means of a permit to prospect, upon payment of \$100, and is held by the expenditure of \$2 per acre in actual boring, during the term of the permit.

When petroleum is discovered in commercial quantities, the land may be leased for exploitation, for a term of ten years, at an annual rental of \$1 per acre, payable in advance.

Quebec.—Exploration rights may be obtained, for one year or more, for a maximum area of 1280 acres, upon an initial payment of \$10 and an annual rental of 10 cents per acre.

Upon the discovery of oil in commercial quantities, an exploitation license is issued for a period of ten years, at an annual rental of 25 cents per acre, payable in advance.

Western Canada.—Regulations governing the mining of oil and gas in the Provinces of Manitoba, Saskatchewan, Alberta, and the railroad belt of British Columbia, are under the jurisdiction of the Department of the Interior, at Ottawa. The rental for the first year is 50 cents per acre, and for subsequent years \$1 per acre, but allowance is made for sums spent in actual development work. In addition to the rental, a royalty must be paid to the Government.

Any company registered or licensed in Canada may obtain exploration and exploitation licenses.

Northwestern Canada.—Exploration rights may be obtained for one year or more, with the privilege of renewal, for a maximum area of 2650 acres, upon a rental of 50 cents per acre for the first year and \$1 per acre for subsequent years.

When oil is discovered in commercial quantities, an exploitation lease may be obtained for a period of twenty-one years, for one-fourth of the area granted for exploration.

GERMANY

INTRODUCTION

The German Republic is situated in the central part of western Europe, with a coastline on the North and Baltic Seas. It has an area of 185,000 square miles, and a population of 59,800,000 with a density of 323 per square mile. Transportation facilities include 36,000 miles of railway and a vast system of roads, rivers, and canals. There are 144,000 miles of telegraph line and 91,000 miles of telephone line.

Since the abdication of the Kaiser in 1918, Germany has had a federal republican form of government. The President is elected, by universal suffrage, for seven years. With the present abnormal value of the German mark, an accurate statement of the financial situation is impossible. A conservative estimate places the budget deficit for 1922 at \$26,000,000,000 and the National Debt at \$71,000,000,000. The country has many natural resources, including grains, sugar beets, and potatoes; lignite, potash and iron mines; and important fisheries on the North Sea. The manufacturing plants constitute the country's main industry. Since the War there has been an excess of imports over exports; exports include sugar, textiles, iron and steel, machinery, and glassware.

PETROLEUM RESOURCES

PRODUCING FIELDS

Since the cession of the Pechelbronn fields to France, at the conclusion of the War, the only oil production in Germany is

obtained from the northwestern part of the country, in Hanover and Brunswick. The oil comes from limestones and sandstones of Jurassic formation, in immediate contact with the Neocomian beds.

Weitz, near Hanover, is the most important producing field. In this region, shallow holes have been dug for many years, and the oil allowed to collect. In 1889, drilling was started in the Weitz field, and the output soon became commercially important. In this field there are about 80 wells, which vary in depth from 500 to 1500 ft. and yield an average of 7 barrels per day.

The production of the German fields since 1890 is given in the following table (this table includes the production of the Alsatian fields until 1918):

PRODUCTION OF PETROLEUM IN GERMANY

(in U. S. barrels)

1890 . . .	108,296	1907... .	756,631
1891 . . .	108,929	1908 . . .	1,009,278
1892 . . .	101,404	1909. . .	1,018,837
1893 . . .	99,390	1910. . .	1,032,522
1894	122,564	1911 . . .	1,017,045
1895 . . .	121,277	1912. . .	1,031,050
1896 . . .	145,061	1913 . . .	995,764
1897	165,745	1914 . . .	995,764
1898	183,427	1915 . . .	995,764
1899.	192,232	1916. . .	995,764
1900.....	358,297	1917... .	995,764
1901.	313,630	1918... .	711,260
1902	353,674	1919 . . .	925,420
1903.	445,818	1920. . . .	212,046
1904... . .	637,431	1921	200,000
1905	560,963	1922.....	200,000(estimated)
1906.....	578,610		

The Hanoverian crude has a gravity of 17.4° Bé. (0.95 sp. gr.), and shows 25 per cent kerosene, 18 per cent gas oil, 47 per cent lubricating oils, and 2 per cent paraffin.

PROSPECTIVE FIELDS

It is reported that in southeastern Bavaria there are prospective fields of importance, and that asphalt occurs in the Eocene limestone about 15 miles west of Salzburg. There are petroleum indications in Eocene marls and sandstones, on the shores of Lake Tegernsee, and oil shales in northern Bavaria at Aschach near Amberg.

PETROLEUM LEGISLATION

The Government needs for oil are so great, and the available supplies so small, that the development of the oil resources is rigidly controlled by German nationals.

ITALY

INTRODUCTION

The Kingdom of Italy has an area of about 180,000 square miles, and a population of 40,000,000, with a density of 222 per square mile. Transportation and communication facilities include 9700 miles of railway (80 per cent owned by the State) and 55,000 miles of telegraph and telephone lines.

Italy is a constitutional monarchy, with executive power vested in the King and Cabinet, and legislative power in the King and Parliament. The budget deficit for 1922 is estimated at \$820,000,000, and the National Debt at \$18,650,000,000.

The chief products of the country are wheat and wine grapes, which are raised chiefly for home consumption. The principal exports, in order of their importance, are cotton goods, raw silk, and silk manufactures; the imports are wheat, raw cotton, and coal. The bulk of the imports is supplied by the United States (50 per cent), Great Britain, and Argentina; while the exports go chiefly to France (20 per cent), Switzerland, and Great Britain.

PETROLEUM RESOURCES

PRODUCING FIELDS

Petroleum is found in the Emilia District, in the northern part of Italy, south of the Po River; in the Chieti District, about midway along the eastern coast in the Pescara Valley; and in the Liris Valley District, in the southwestern part of Italy between Rome and Naples. In the Emilia and Chieti Districts, the oil is found in commercial quantities in Eocene, Miocene, and Pliocene rocks which are thrown into folds. The structure is complicated,

and at some places it has not been possible to determine what strata yield the oil. In the Liris Valley District, the oil is found in bituminous limestone of Cretaceous age and in petroliferous Eocene shales, with occasional Pliocene deposits.

The development of the Italian fields began in 1860, when 36 barrels were produced. At present there are small wells at Montechinio, Valleia, Salsomaggiore, Medesana, Miano, and Nirano in the Emilia District; and at Tocco, Santa Elia, and Manopello in the Chieti District. Production is small, and the oil is consumed locally.

The production of the Italian fields since 1890 is shown in the following table:

PRODUCTION OF THE PETROLEUM IN ITALY
(in U. S. barrels)

1890....	2,998	1907....	59,875
1891....	8,305	1908....	50,966
1892....	18,321	1909.....	42,388
1893.....	19,069	1910....	50,830
1894....	20,552	1911 ...	74,709
1895.....	25,843	1912....	53,778
1896....	18,149	1913....	47,198
1897....	13,892	1914....	39,849
1898.....	14,489	1915....	43,898
1899....	16,121	1916....	50,585
1900.....	12,102	1917....	40,763
1901.....	16,150	1918....	35,953
1902.....	18,933	1919....	38,254
1903.....	17,876	1920.....	34,180
1904....	25,476	1921....	34,400
1905....	44,027	1922.....	35,000 (estimated)
1906.....	53,577		.

The crude has a gravity of about 45° Bé. (0.80 sp. gr.), and contains 30 per cent gasoline, 52 per cent kerosene, and 12 per cent lubricating oils.

PETROLEUM LEGISLATION

A Royal Decree, dated the 7th of January, 1917, provides that the subsoil belongs to the State. Exploration permits for oil

and gas are granted upon the deposit of a certain amount, for the satisfaction of casual damages. The owner of land covered by such a permit cannot object to exploration.

The State will grant a concession for the exploitation of oil, which may be renewed on expiration, for a period of seventy-five years. In districts where the law gives to the owner of the land the ownership of the subsoil, he is entitled to an annual payment of 50 lire per ton of oil extracted.

The Italian law does not discriminate against foreigners or foreign companies, and several British companies are at present interested in the oil development.

The Government grants premiums, regulated by the law of the 19th of March, 1921, to searchers for oil, for every meter which has been drilled below the depth of 300 meters. These premiums are increased for the districts where petroleum has never been exploited.

SCOTLAND

INTRODUCTION

Scotland, which lies in the northernmost part of the British Isles, has an area of 30,000 square miles and a population of 4,900,000. Transportation facilities include 4000 miles of railroad, 150 miles of canals, and many miles of navigable rivers.

Since the Act of Union, of 1707, Scotland forms with England the Kingdom of Great Britain, although its people retain characteristics which distinctly differentiate them from the English.

Scotland is famous for its woolen mills and shipyards; these industries engage about 50 per cent of the employed population. Foreign trade statistics are included with those of England.

OIL SHALES

Although Scotland has no valuable deposits of petroleum, it holds an interesting position in the oil industry on account of the long and systematic exploitation of its oil-shale deposits. The principal shale deposits are located in a belt 6 miles wide by 15 miles long, in Linlithgow and Midlothian Counties, west of Edinburgh.

The industry dates back to 1850, when Dr. James Young invented his process for obtaining oil from shale by slow distillation. The yearly output aggregates about 3,000,000 tons of shale, yielding 1,200,000 barrels of oil.

The production of oil shale in Scotland since 1904 is shown in the following table:

PRODUCTION OF OIL SHALE IN SCOTLAND

(in tons)

1904 . . .	2,331,885	1914	3,268,435
1905 . . .	2,493,081	1915	2,992,676
1906 . . .	2,545,724	1916	3,009,232
1907 . . .	2,690,028	1917	3,116,529
1908 . . .	2,892,039	1918	3,223,076
1909 . . .	2,967,017	1919	2,814,110
1910	3,130,280	1920	2,900,000 (estimated)
1911	3,116,803	1921	3,000,000 “
1912	3,184,826	1922	3,000,000 “
1913	3,279,903		

PETROLEUM LEGISLATION

The five Scottish Oil Shale companies were consolidated in 1919 and are now owned by a subsidiary of the Anglo-Persian Oil Company, which is in turn controlled by the British Government.

Petroleum-bearing lands may not be sold or transferred to aliens without the consent of the Board of Trade.

PROSPECTIVE FIELDS

UNITED STATES POSSESSIONS

ALASKA

INTRODUCTION

The Alaskan Peninsula is situated in the extreme northwestern part of the American Continent, and is separated from Siberia in Asia by Bering Straits, which have a minimum width of 50 miles. The country has an area of about 590,000 square miles and a population of 55,000, half white and half Eskimos. The transportation in Alaska is facilitated by its long coast line, which affords good anchorage and ready accessibility to a large part of the country during the warm weather. During the long winter the harbors are ice-bound and inaccessible, and land transportation is afforded by dog-drawn sleighs. There are about 800 miles of railroad.

Alaska was purchased from Russia by the United States in 1867; and by act of Congress, in 1912, it became a Territory, with a Governor, appointed by the President of the United States, and a Legislative Assembly elected by the people. There is no provision for real or personal taxes except for municipal purposes, and all revenues are derived from licenses to conduct business. The territory has no funded debt.

The bulk of the foreign trade is with the United States. The chief industries are seal and salmon fisheries, and copper and coal mining.

PETROLEUM RESOURCES

Petroleum indications are found on the southern or Pacific seaboard, from east to west, at Yokataga, Katalla, Iniskin Bay, and Cold Bay.

The Yokataga prospective field lies in the southeastern part of the peninsula, near Cape Yokataga, where petroleum seepages occur on sandstone overlain by shale of Oligocene or lower Miocene age. No drilling has been done in this region, as the lack of protected anchorages along the coast makes it rather inaccessible.

The Katalla District is about 80 miles west of Yokataga on the north shore of Controller Bay between the Bering and Copper Rivers. Oil seepages and gas springs extend here also for several miles along the coast. Between 1901 and 1904 drilling work was carried on at several places, and small producers were obtained between the town of Katalla and the Bering River. A small quantity of oil is now obtained from 11 wells. The product is refined and sold locally. The formations consist of a series of intensely folded and faulted shales, sandstones, and conglomerates of Tertiary age. Katalla, the distributing point for this field, is a small settlement at which freight can be landed only during favorable wind conditions.

The Iniskin Bay District is located on a small peninsula on the west shore of Cook Inlet. Petroleum seepages have been found near Iniskin, Oil, and Dry Bays, in fine-grained sandstone interbedded with clay shales of middle Jurassic age; the seepages occur in the eastern limb of a broad anticlinal arch which has been somewhat faulted. Some desultory drilling was carried on from 1901 to 1904, with indifferent success. The field is readily accessible from the good harbors lying both north and south.

There are a number of oil seepages and gas springs at Cold Bay, which is an indentation on the southwestern shore of the Alaskan Peninsula. Some drilling was done in 1903 and later, but this was abandoned. Of late, two American companies have made arrangements to prospect this region seriously, and exploratory drilling is planned at Portage Bay in this district.

Besides these four known districts, the presence of petroleum has been reported at Smith Bay on the northern coast, about 100 miles east of Point Barrow; but the conditions of transportation would prohibit commercial development at the present time.

The Alaskan petroleum so far recovered is a refining oil of paraffin base, similar to that of Pennsylvania and has a high percentage of volatile fractions and contains but little sulphur. The gravity is about 45° Bé. (0.80 sp. gr.).

PETROLEUM LEGISLATION

Any bona fide occupant of oil- or gas-bearing lands in Alaska, who had expended not less than \$250 for improvements prior to the passage of the Oil Leasing Act, dated the 25th of February, 1920, is entitled to a prospecting permit requiring that drilling operations shall begin within two years.

PHILIPPINE ISLANDS

INTRODUCTION

The Philippine Islands form the largest group of the Malay Archipelago and extend north and south from Formosa to Borneo. The group is composed of about 7000 islands, with an area of approximately 115,000 square miles. The largest islands are Luzon, Mindanao, Panay, Leyte, and Cebu. The population, chiefly native Malays, is estimated at 10,000,000. English is the official language, but native dialects and Spanish are also used. The bulk of overseas shipments is made from Manila, and the inter-island or coastwise trade is carried on by over 400 vessels. The land transportation facilities include about 800 miles of railroad, owned and operated by the Government, and 6000 miles of good wagon roads.

The Philippines were ceded to the United States by Spain in 1899 and have since been ruled by a Governor General appointed for four years by the President of the United States. The Legislature is made up of two bodies elected by popular vote. Govern-

ment revenues have, for several years, shown a surplus over expenditures. The debt of the islands is estimated at \$21,000,000.

The United States handles more than half of the foreign trade, although imports are received from Japan and China and exports are shipped to Great Britain and Holland. The chief products, in order of their importance, are rice, sugar, manila hemp, and tobacco.

PETROLEUM RESOURCES

Indications of petroleum are reported on Luzon Island at Macabebe and Manalan in Pampanga, at Santo Tomas in Batangas, and at Bondac in Tayabas; on Panay Island near Dumaroa in Capiz and northwest of Iloilo; on the west coast of Cebu Island at Toledo, reaching south to Algeria and north to Asturias; on Leyte Island in the northwestern part near Villaba; and on Mindanao Island east of Lake Lanao. All known seepages, petroleum residues, and natural gas emanations are associated with Tertiary sediments. Two wells were drilled on Bondac without commercial returns; at present a California company is drilling in this region, and other oil interests are negotiating for concessions. Samples of Philippine crude show a gravity of 39° Bé. (0.828 sp. gr.) and contain 15 per cent gasoline, 32 per cent kerosene, 47 per cent lubricating oils, and 3 per cent coke.

PETROLEUM LEGISLATION

According to the law of August, 1920, all public lands containing petroleum or other mineral oils, on which no patent had been issued prior to August, 1920, are withdrawn from sale and are declared to be free and open to exploration, location, and lease by citizens of the Philippine Islands or of the United States, and by associations and corporations wholly composed of citizens of the Philippine Islands or of the United States or both. Such lands may be leased for exploitation by the Secretary of Agriculture and Natural Resources, subject to the terms prescribed by the Council of the State, in tracts of no more than 400 hectares to

each individual, and not more than 1200 hectares to any association or corporation. Leases are granted for no more than five years, but they are subject to renewal. No assignment of said leases can be made without the consent of the Secretary of Agriculture and Natural Resources.

The exploration and exploitation of oil located in private lands may be carried on only by persons or corporations having the qualifications required of lessees, and under such terms and conditions as may be prescribed by the Secretary of Agriculture and Natural Resources and approved by the Council of the State. Any location, occupation, or use by locators of any private land for the purpose of exploring and working any mineral deposits is conditioned on just compensation.

BRITISH EMPIRE

ENGLAND

INTRODUCTION

England, the seat of the government of the British Empire, occupies the southern half of the Island of Great Britain. It has an area of about 50,000 square miles and a population of approximately 35,000,000. Transportation and communication facilities include about 16,000 miles of railroad, 4000 miles of canals, and 285,000 miles of telegraph lines.

The executive power of the Government is vested in a Cabinet whose existence depends on a majority in the House of Commons. England is one of the few European countries which has at present a balanced budget. Revenues for 1922 were estimated at \$6,000,000,000, and expenditures at \$5,000,000,000. The National Debt is approximately \$38,000,000,000. Pre-war London was considered the financial center of the world, and many contend that it is regaining the financial leadership which it was forced to yield to New York City.

England's principal industries are manufacturing, shipping, agriculture, and coal mining. Because of her comparatively small area and dense industrial population, most of the raw materials must be imported to be manufactured and exported as finished products. The chief imports, in order of their value, are fresh and salted meats, raw cotton, wheat, petroleum, butter, wool, and sugar; the principal exports are cotton goods, woolens, coal, ships, and iron and steel manufactures. The countries, in order of their importance, from which England obtains her raw materials are the United States, Argentina, Australia, Canada,

and France; exports are sent chiefly to India, the United States, France, Australia, and the Netherlands.

PETROLEUM RESOURCES

Petroleum indications are found in the central part of England, in the counties of Derbyshire and Staffordshire. Seven wells have been drilled in East Derbyshire, but only one has proved productive; this well is located at Hardstoft and yields about 7 barrels a day from a depth of 3000 ft. Indications of oil have also been reported at other places, and a well at Heath obtained a flow of natural gas estimated at 400,000 cu. ft. per day. Two wells were bored in North Staffordshire near Stoke-on-Trent, without commercial results.

The oil from the Hardstoft well has a gravity of 40.1° Bé. (0.823 sp. gr.) and contains about 7½ per cent gasoline, 39 per cent kerosene, 20 per cent gas oil, and 30 per cent lubricating oils.

The refinery of the Anglo-Persian Oil Company at Llandarcy near Swansea, Wales, is the only one in Great Britain equipped to produce all of the chief petroleum products.

PETROLEUM LEGISLATION

Petroleum development in the British Isles is entirely a Government enterprise, or under strict Government control. It is unlawful for a British subject to transfer to an alien or to a foreign-controlled company, without the consent of the Board of Trade, any interest in a company exploiting oil in Great Britain.

BARBADOS

INTRODUCTION

Barbados Island lies east of the Windward Islands and north of the Island of Trinidad; it has an area of 166 square miles and a population estimated at 200,000, most of whom are negroes. The transportation facilities of the island include 470 miles of roads, and 28 miles of railway belonging to the Government.

The island is a British Colony, with a Governor, Executive and Legislative Councils, appointed by the King, and an Assembly elected by the people. The National Debt is estimated at \$2,000,000.

About 70 per cent of the land is used for raising sugar cane and cotton, which are exported in large quantities. Coal, for bunkering ships, and cotton goods are the chief imports.

PETROLEUM RESOURCES

Petroleum is found on the eastern coast of Barbados near Saint Andrew, in Miocene sandstones and shales, much disturbed and broken by faults. The oil is obtained from shallow pools, and from dug wells 80 to 140 ft. deep. While the production is not large, the wells yield steadily; the largest amount from any one well is 25 barrels a day. The oil has a gravity of 18.9° Bé. (0.94 sp. gr.) and contains 94 per cent lubricating oils and 5 per cent asphalt.

PETROLEUM LEGISLATION

The Oil Mines Act empowers the Governor, in executive committee, to make regulations and to grant exploration and exploitation rights within any given area, without regard to nationality. The Government has the right of pre-emption over all oil residues.

A grant to the British Union Oil Company provides that the privileges and powers therein shall not be conveyed or extended to any successors of the company of a nationality other than British.

GRENADA

INTRODUCTION

The Island of Grenada forms part of the British West Indies and lies northwest of Trinidad Island, another British possession. It has an area of 133 square miles and a population of about 65,000, with a density of 488 per square mile.

Grenada is a British colony governed as a part of the Windward Islands, under a common Governor and a separate Legislative Council. The National Debt is estimated at \$1,000,000.

Agriculture is the principal industry, with cocoa, nutmegs, and cotton as the chief products. Great Britain and the United States control the foreign trade.

PETROLEUM RESOURCES

Like many of the neighboring islands, Grenada is of volcanic origin; and the indications of oil, which are reported at several localities off the coast, are attributed to distillation by volcanic agency from deep-seated bituminous deposits.

PETROLEUM LEGISLATION

The petroleum legislation of Grenada conforms to the established policy of the British Empire of giving exclusive exploration and exploitation rights only to British subjects.

MESOPOTAMIA

INTRODUCTION

Mesopotamia, or Iraq, occupies a territory of about 140,000 square miles in the southwestern part of Asia, between Persia and Arabia. It has a population estimated at 2,800,000. The country has a short coastline at the head of the Persian Gulf, with only one important port, Basra. The Tigris and Euphrates are navigable and were formerly the only means of communication with Baghdad and the interior, but these waterways are now in a large measure superseded by the 950 miles of military railroad connecting Basra and Baghdad with towns farther inland. There are about 3000 miles of telegraph and telephone lines.

Mesopotamia was conquered by Great Britain during the Great War and, by the Treaty of Peace with Turkey, is recognized as an independent state under the mandate of Great Britain. The country has incurred no debt.

Agriculture and the working of petroleum wells are the principal industries. Petroleum, barley, cotton, and dates are the chief products. The chief exports, in order of their importance, are cotton piece goods (sent by caravan to Persia), dates, carpets, and grain. Cotton goods for domestic use and reshipment to Persia are the most important import, with sugar, tea, and silk coming next in importance. India, England, Persia, and Arabia control the commerce of Mesopotamia.

PETROLEUM RESOURCES

Although small production of petroleum and asphalt, from springs and shallow pits, has been obtained from several localities in Mesopotamia since Biblical times, no systematic or up-to-date development of the oil resources has yet been undertaken. At present, these primitive workings yield oil at Mandali, Kifri, Kerkuk, Gayara near Mosul, and asphalt at Hit on the Euphrates.

The prospective oil fields include the present productive pools and a zone extending southeast from Mosul to the region near Baghdad. There are also possibilities of developing important deposits along the Valley of the Euphrates from Hit to El Deir.

The oil generally occurs in Miocene rocks which consist of sandstones, marls, and limestones permeated with salt; in sulphurous and saline springs; in oil and gas seeps; and in deposits of asphalt.

The present annual yield of asphalt is estimated at 175,000 barrels. At Kerkuk there are about 20 springs which give an annual yield of 2000 barrels. About the same amount is refined each year at Mandali, where oil is obtained from 30 shallow, hand-dug wells; this oil contains about 30 per cent kerosene and 70 per cent fuel oil. The Mosul oil has a gravity of 74.3° Bé. (0.685 sp. gr.).

PETROLEUM LEGISLATION

It is reported that the French and British reached an agreement at San Remo for a joint development of the oil resources of

Mesopotamia. However, as a result of the recent Turkish wars, the Turks regained many of their lost domains, among which were certain rights to the oil region of northern Mesopotamia, near Mosul. The Turks have recognized the British claims, but the British have agreed to pay the Turks a 25 per cent royalty on Mosul oil and to loan them between \$250,000,000 and \$500,000,000. The Mosul oil field is distributed among the following interests:

	Per Cent
Anglo-Persian Oil Company.	40
French Interests	20
Royal Dutch Shell Company	20
American Interests	20
Total.....	100

PALESTINE

INTRODUCTION

Palestine lies along the eastern shores of the Mediterranean Sea and extends east to include the valley of the Jordan River. It has an area of 9000 square miles and a population of 770,000; about 80 per cent of these are Turks or other Moslems, and 10 per cent Jews. Arabic is the common language, but English and Hebrew are also recognized as official. The climate is dry and healthful, with occasional rains between November and May. Transportation facilities include 625 miles of railroad and 525 miles of wagon roads. The most important ports are Jaffa and Haifa along the Mediterranean coast.

Under the treaty of Sèvres, in 1918, Turkey renounced her sovereignty over the Holy Land, and the mandate of Palestine was transferred to Great Britain. There is no National Debt.

The principal industries are agriculture and wine-making. The chief exports, in order of their importance, are oranges, soap, and wine; the chief imports are cotton goods, sugar, rice, and petroleum. Great Britain, Egypt, and the United States control the foreign trade of Palestine.

PETROLEUM RESOURCES

Petroleum indications are found in oil-shale deposits in the Yarmuk Valley, in northern Palestine, near Jerusalem, Bethlehem, and Hebron, to the west of the Dead Sea; and near Kerak, Ketrana, and Deschiga southeast of the Dead Sea. The Bedouins have used these shales for fuel for a number of years, and during the Great War the Germans obtained oil from the distillation of them. No concentrated effort has been made to exploit these deposits.

PETROLEUM LEGISLATION

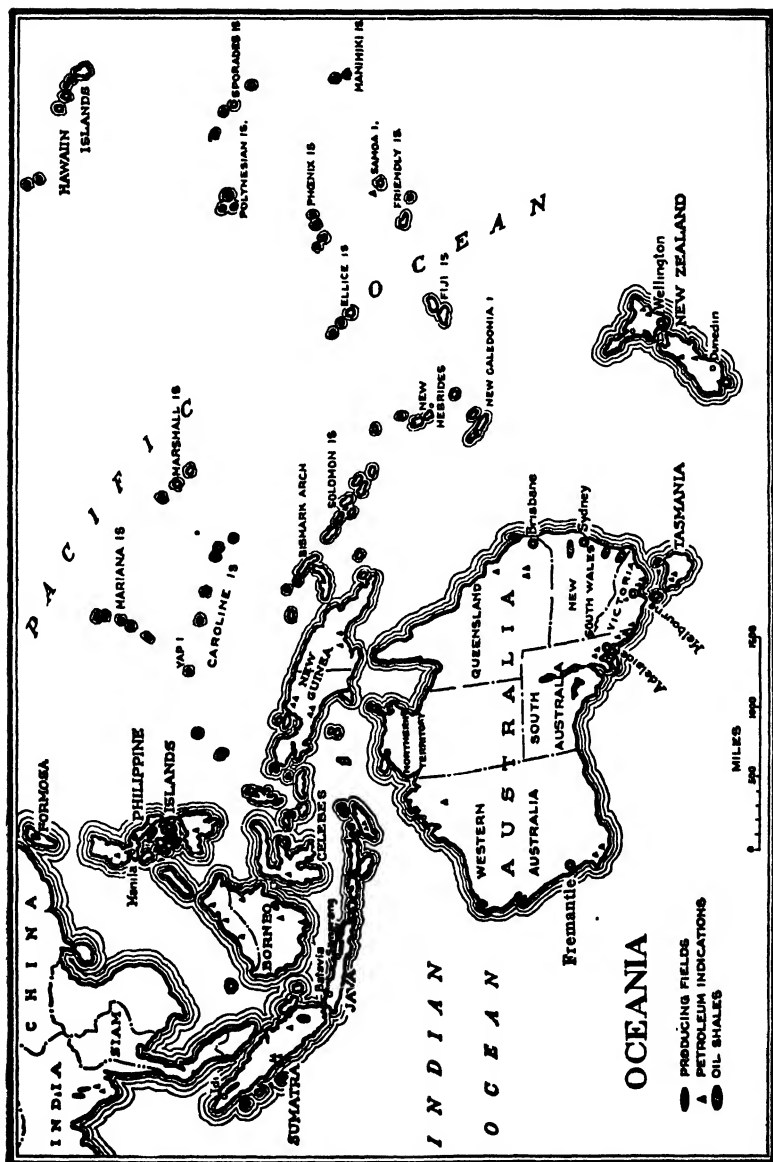
It is reported that American interests acquired concessions from Turkey, in 1912, for the exploration and exploitation of the oil resources in Palestine, and that these concessions have been recognized by the British Government now in authority.

AUSTRALIA

INTRODUCTION

Australia is the largest island in the world, with an area of 3,000,000 square miles and a population of about 5,000,000. It forms the Commonwealth of Australia, which includes the colonies of New South Wales, Victoria, Queensland, South Australia, Western Australia, and Tasmania. The transportation and communication facilities include about 23,000 miles of Government-owned railway and many miles of telegraph and telephone lines.

The Commonwealth is a British Territory, with executive power vested in a Governor General appointed by the King, and legislative power vested in a representative Parliament. Prior to the War, Government revenues exceeded expenditures; the accumulated surplus at the end of 1922 was about \$15,000,000, which offsets an estimated budget deficit of \$12,000,000. The National Debt is estimated at about \$1,956,000,000.



Australia leads the world in wool production. Sheep and cattle raising and agriculture are the leading industries; wheat, oats, maize, barley, hay, and potatoes are the chief products. Exports go chiefly to Great Britain, the United States, and New Zealand, and include wheat and wool. Imports, including cotton piece goods and other textiles, metal manufacturers, and machines, come from Great Britain and the United States.

PETROLEUM RESOURCES

Oil indications are reported in the northern part of Western Australia near Mount Wynne in the Kimberley District, in the southwestern part near the confluence of the Warren and Donnelly Rivers near Cape Leeuwin; in the southeastern part of South Australia at Gawler near Adelaide, along Salt Creek near Meningie, at Bordertown, along the Coorong Lagoon, and on Kangaroo Island; in the southeastern part of Queensland, near Duaringa and Beaudesert (gas is also found near Ronna); in Victoria northwest of Melbourne at Bridgewater, along the coast at Portland, Western Port, and Cape Patterson; and in the northwestern part of Tasmania in the Inglis and Don Valleys.

The oil shales of New South Wales are located along the coast from Twofold Bay to Jervis Bay, and farther north and inland at Coonamble and at Gunnedah. They are reported to be among the richest in the world. Prospecting is going on, but no development work of commercial value has been done.

PETROLEUM LEGISLATION

Each Colony in Australia has its own mining legislation. In general, these laws provide that only British subjects may receive exploration or exploitation rights, for a period exceeding five years, without the written consent of the Attorney General.

NEW ZEALAND

INTRODUCTION

The Dominion of New Zealand, including North, South, and Stewart Islands, is situated 1200 miles southwest of Australia. It has an area of about 103,000 square miles and a population estimated at 1,200,000 British colonists. The transportation facilities include 3000 miles of Government railroads on North and South Islands.

New Zealand was founded as a British colony in 1840, and raised to the status of a Dominion in 1907. Government is administered by a Governor General and a Commander-in-Chief, assisted by a Cabinet and General Assembly. The suffrage is universal, and is extended to native Maoris. Government revenues have usually exceeded expenditures. The National Debt is estimated at \$928,000,000.

The foreign trade is carried on with Great Britain, the United States, Australia, and Canada. The chief exports, in order of their importance, are wool, frozen meats, cheese, and sheep skins; the chief imports are textiles, automobiles and motorcycles, iron and steel, and metal manufactures.

PETROLEUM RESOURCES

Oil and gas seepages are reported on North Island, on the southwestern coast at New Plymouth, Taranaki, and the northern slope of Mount Egmont; on the western coast at Gisborne, Poverty Bay, and Hawkes Bay. The indications on South Island are in the northwestern part where there are a few hand-dug pits and shallow wells near Lake Brunner at Kotuku. The only indications of importance are those at New Plymouth on North Island. The formations involved in the geology of North Island consist of clays of Pliocene age associated with volcanic rocks, sands, and

conglomerates; salt water is associated with the oil. The petroleum on South Island is found in rocks of lower Tertiary age.

Four wells were drilled at Taranaki and produced a total of about 100 barrels a day, which was refined locally. The venture was unsuccessful, and the entire project has been abandoned. The New Zealand oil has a gravity of about 36.6° Bé. (0.84 sp. gr.) and contains about 15 per cent gasoline, 42 per cent kerosene, 20 per cent lubricating oils, and 13 per cent paraffin.

PETROLEUM LEGISLATION

A special feature of New Zealand mining legislation is that, although it has not provided for any reservations of minerals from grants of Crown lands, an early Act, called "The Resumption of Land, for Mining Purposes, for the Crown," gave the Crown power to resume, for mining purposes, on payment to the owner for the value, any land which might be alienated after the date of that Act, except lands alienated expressly for mining purposes. At present, therefore, all land alienated by the Crown since the Act of 1873, and (with the consent of the owners) all land alienated previously to that date is liable to be resumed for mining purposes.

No nationality restrictions are imposed on prospecting and mining by foreigners.

PAPUA

(BRITISH NEW GUINEA)

INTRODUCTION

New Guinea, one of the largest islands in the world, was, prior to the War, divided into Dutch, German, and British colonies; but in 1914 the German area was occupied by British forces and was subsequently ceded to Great Britain. The British possession

now occupies the eastern part of the island, with an area of 90,000 square miles and a population of about 251,000 native Papuans. Land transportation facilities are very poor; there are no railroads, and road construction is slow and costly.

The Territory of Papua (as it is now officially called) is governed by an Executive Council nominated by the Governor General of Australia. Government revenue is derived from customs duties and from an annual subsidy provided by the Australian Government.

The country is divided into large plantations, where coconuts, rubber, and hemp are cultivated for export; copra, pearls, copper ore, and timber are also exported. The chief imports are foodstuffs, tobacco, textiles, and hardware.

PETROLEUM RESOURCES

The petroleum indications occur from the mouth of the Ourari River almost to Yule Island, along a zone several miles inland paralleling the coast. The formations involved are Miocene shales and sandstones, with minor limestone layers. Test wells have been drilled with considerable difficulty, owing to the cavy nature of the unconsolidated beds; some of the wells tapped gas reservoirs, while others struck oil in small volumes with a gravity of 45° Bé. (0.80 sp. gr.). Drilling is now going on at Popo.

PETROLEUM LEGISLATION

It is reported that the Anglo-Persian Oil Company, which has obtained concessions covering large parts of the prospective oil regions, is carrying on geological investigations, and all other prospectors have been warned to keep off.

GOLD COAST

INTRODUCTION

The Gold Coast is a British possession, situated in the western part of Africa between the French Ivory Coast and Togoland. It includes the Colony, Ashanti, and the Protectorate, with a total area of about 80,000 square miles and a population of 2,100,000 native negroes. The transportation facilities include a Government railway, 168 miles in length from Seccondee, on the coast, to Coomassie, 24 miles of branch lines, an 85-mile line from Accra to Anyinam, and about 320 miles of main wagon roads.

The country is under the administration of a British Governor and an Executive and Legislative Council. The National Debt of the colony is estimated at \$16,000,000.

The chief export of the Gold Coast is cocoa, valued at \$50,000,000 yearly; gold, valued at \$4,500,000, is also exported. The chief imports, in order of their importance, are cotton goods, motor cars, and foodstuffs. The foreign trade is carried on with Great Britain, the United States, and France.

PETROLEUM RESOURCES

Large quantities of bitumen and numerous traces of oil are reported near the coast, in the territory of Appollonia about 40 miles from Axim, where, in some places, oil is easily collected by making shallow excavations in coarse bituminous sand. The oil is dark brown in color and has a gravity of 13° Bé. (0.979 sp. gr.). In the region between Ajubanso and Ehboaso, and extending from the coast to the Tano River, prospective wells drilled near Takinta obtained encouraging results.

PETROLEUM LEGISLATION

The Mineral Ordinance of 1905 states that minerals include mineral oil.

Natives only are entitled to land grants in the colony; therefore, concessions are obtainable only from the natives having the power to grant them, subject to the approval of the Government. Concessions should be registered immediately after they are obtained. Only British subjects may obtain these concessions. Prospecting may be commenced upon a license issued by the Government, before the concession has been obtained. A royalty of 5 per cent of the assessed profits must be paid to the State.

NIGERIA

INTRODUCTION

Nigeria is a British possession, situated in the western part of Africa on the Gulf of Guinea, between Dahomey and French Equatorial Africa. It has an area of 332,000 square miles and a population estimated at 16,300,000. Transportation facilities include 1100 miles of railway; caravans are used extensively in the interior.

The country is ruled by an Executive Council. Government revenues usually exceed expenditures; the National Debt is estimated at \$57,000,000.

The foreign trade is controlled by Great Britain and the United States. The chief exports, in order of their importance, are palm kernels, palm oil, tin ore, and cocoa; the chief import is cotton piece goods.

PETROLEUM RESOURCES

Many indications of petroleum are reported in southern Nigeria, where a number of wells have been sunk without commercial success. The oil in this region has a gravity of 30.5° Bé. (0.872 sp. gr.). A British corporation obtained a concession covering an area of 225 square miles in southern Nigeria, but lack of capital prevented extensive exploitation.

PETROLEUM LEGISLATION

The underlying principle of the mineral ordinance of 1916 is that the entire property of the mineral oils in Nigeria is vested in the Crown.

The mineral oil ordinances of 1914 provide that a license or lease for exploration shall be granted by the Government, with the approval of the Secretary of State. Licenses for exploitation are granted only to British subjects or to British companies, upon a deposit of £1000 and upon the payment to the Government of a royalty of 5 per cent of the production, in oil or in money at current commercial prices.

BRITISH SOMALILAND

INTRODUCTION

British Somaliland is located in eastern Africa at the head of the Gulf of Aden, adjoining Abyssinia and Italian Somaliland. It has an area of about 68,000 square miles, and a population of 300,000 which is Mohammedan and almost entirely nomadic. The transportation facilities of the country are very poor, and the bulk of the inland trade is carried by camels.

The country is under the protection of Great Britain, which assists it financially by yearly appropriations rendered necessary because of the excess of expenditures over revenues. There is no National Debt.

The chief exports, in order of their importance, are hides, gum, and raisins; the chief imports are rice, textiles, and dates.

PETROLEUM RESOURCES

Petroleum indications are reported near Berbera in the northern part of Somaliland. The oil obtained from a pit at Daga Shabell has a gravity of 26° Bé. (0.897 sp. gr.).

PETROLEUM LEGISLATION

In Somaliland, contrary to the usual British policy, there are no restrictions against foreigners in the exploration and exploitation of oil.

RHODESIA**INTRODUCTION**

The territory of Rhodesia in southern Africa extends from the Transvaal Province north to the borders of the Congo States and Tanganyika Territory. It has an area of about 440,000 square miles and a population of about 1,800,000. The transportation facilities include the Rhodesia Railway system from Vryburg, in Cape Colony, to the Congo State border, a distance of over 2000 miles, and several branch lines, making a total of 2500 miles. The telegraph system consists of about 8000 miles of line.

The territory is under the administration of the British South Africa Company, which is assisted in Southern Rhodesia by a Resident Commissioner and Executive and Legislative Councils, and in Northern Rhodesia by a Resident Commissioner and an Advisory Council.

Rhodesia is rich in gold and other minerals; the yearly gold output is valued at \$15,000,000. The country is also well adapted for cattle raising. The chief exports, in order of their importance, are gold, copper, maize, and asbestos; the chief imports are clothing, piece goods, and machinery.

PETROLEUM RESOURCES

Petroleum indications are reported near the confluence of the Limpopo and Umzingwani Rivers in the southern part of the country.

PETROLEUM LEGISLATION

The petroleum legislation of Rhodesia conforms to the established policy of the British Empire in the development of the oil resources. Only British subjects may hold oil concessions.

UNION OF SOUTH AFRICA**INTRODUCTION**

The Union of South Africa, as its name implies, is situated in the southern part of Africa and includes the states of Cape of Good Hope, Natal, Transvaal, and the Orange Free State. It has an area of about 474,000 square miles, and a population estimated at 7,140,000, of which one-fifth are white and the remainder native negroes. The transportation and communication facilities include 10,000 miles of Government-owned railways and 16,000 miles of telegraph and telephone lines.

The chief executive of the Union is a Governor General appointed by the King of England; the legislative body is elected by the colonists. Since 1920, Government expenditures have exceeded revenues, and the budget deficit in 1922 was estimated at \$30,000,000. The National Debt is approximately \$847,000,000.

Wheat raising is becoming more important since the development of irrigation. The chief exports are gold, valued at about \$200,000,000 annually, wool, and diamonds; the chief imports are foodstuffs and clothing. About 50 per cent of the foreign trade is carried on with Great Britain; the United States comes second, with about 20 per cent.

PETROLEUM RESOURCES

Oil indications are reported in Cape Colony, near Calvinia, Fraserburg, Carnarvon, Hanover, and Barkly. In the Orange Free State, ozokerite is found near Christiana, and petroleum near

Boshof, Harrismith, Bethlehem, Lindley, and Heilbron, and gas not far from Kroonstad. In the Transvaal, oil indications occur about 60 miles northwest of Potchefstroom; oil shales are present in the region of Wakkerstrom, Piet Retief, Ermelo, and Middleburg. The oil indications in the Union are closely associated with igneous dikes which intrude bituminous beds of Triassic age.

Drilling operations in Cape province have been abandoned after many years of prospecting.

PETROLEUM LEGISLATION

No nationality restrictions are imposed upon the exploration and exploitation of oil in the Union of South Africa.

FRENCH POSSESSIONS

MOROCCO

INTRODUCTION

The Sultanate of Morocco is situated in the northwestern part of Africa along the Mediterranean Sea and the Atlantic Ocean. It has an area of about 231,000 square miles, and a population of 6,000,000, consisting of Berbers, Tuaregs, Shellahs, Arabs, Jews, and negroes. France controls about 220,000 square miles of territory and about 5,400,000 of the population, while Spain claims as her zone of influence about 11,000 square miles between the Rif Mountains and the Mediterranean and 600,000 inhabitants. The transportation facilities include about 700 miles of narrow-gauge military railway and 1560 miles of good automobile roads.

The Sultan is an absolute ruler under the Mandate of the French Government, exercised through the French Resident Governor with headquarters at Rabat. The National Debt is estimated at \$103,000,000, and nearly the entire amount is owed to France.

The most important product is barley, which is consumed locally. The imports are valued at four times the amount of the exports. The chief exports, in order of their importance, are beans, eggs, and linseed; the chief imports are sugar and cotton goods. About 60 per cent of the foreign trade is controlled by France and Algeria.

PETROLEUM RESOURCES

Indications of petroleum, traces of gas, asphaltic sands, and bituminous shales are found in Morocco, south of the Rif Moun-

tains, from the vicinity of Rabat on the Atlantic to Taza on the Sebu River. The most important deposits are those at Djebel Selfat Mountains, near the main road from Rabat to Fez, about 12 miles east of Petijeau, and those near Hadjer-el-Ouakef and Es-Sebt des Oudaia in the same general region.

The oil is found in Miocene clays and sandstones associated with igneous rocks. The marls and clays of the Miocene, the shales of the middle Liassic, and dolomites of probable Triassic age are frequently impregnated with hydrocarbons. The formations at Djebel Selfat appear to be sharply disturbed and overturned in places. Exploration work, so far undertaken in a desultory manner, has not proven the existence of oil in commercial quantities.

PETROLEUM LEGISLATION

Exploration authorizations are granted on priority of registration; they are good for three years upon payment of a yearly tax of 2 cents per hectare. These authorizations give a priority right to obtain exploitation authorizations. A yearly tax of 3 per cent, on all the production that is exported, must be paid to the Government. There is no tax on domestic consumption.

ALGERIA

INTRODUCTION

The French Colony of Algeria is situated in the north central part of Africa on the Mediterranean Sea and, with Morocco and Tunis, forms the French zone of influence in this region. It has an area of 222,000 square miles and a population of 5,800,000. Transportation and communication facilities include 2200 miles of railway, 3300 miles of national roads, and 14,000 miles of telegraph and telephone lines.

The Colony is administered by a Governor General appointed by the French Government. For a number of years a balanced

budget has been maintained. The National Debt is estimated at \$35,000,000.

The chief products are wheat, barley, and wine grapes. The chief exports, in order of their importance, are wines, wheat, sheep, and tobacco; the principal imports are seed oil, cotton, metal products, and coal. France controls 70 per cent of this trade.

PETROLEUM RESOURCES

Oil indications are reported at Ain Zeft, near the town of Oran, not far from the Mediterranean; near Relizane, south of Sheliff Plain; in the Dahra region, between Orleansville and Mostaghannem, north of Sheliff Plain; all these regions are located in the Department of Oran. In the Department of Constantine, seepages are reported near Claire-fontaine, about 40 miles south of Ahras. In the Department of Oran, seepages occur in upper Miocene formations, while the seepages in Constantine occur in middle Cretaceous limestones.

Exploration began in 1880 near Ain Zeft, where a well was sunk through Pliocene and Miocene formations to about 1200 ft., but production was irregular and seldom yielded more than a few barrels a day. Again in 1897, several wells were sunk without results, at depths varying between 1500 and 2400 ft. Numerous wells yielding small quantities of oil have been sunk in the Relizane District, but the commercial value of the field remains to be proven.

Ain Zeft crude has a gravity of 14.3° Bé. (0.97 sp. gr.) and contains 3½ per cent gasoline and 95 per cent paraffin; the Relizane crude is lighter, with a gravity of 38.7° Bé. (0.83 sp. gr.), and contains 5½ per cent gasoline, 54 per cent kerosene, and 4 per cent paraffin.

PETROLEUM LEGISLATION

Exploration authorizations are easily obtained, but carry no guaranty of obtaining a concession.

No exploitation license is granted unless wells have been sunk

and unless oil has been found and produced, but the absolute concession for the exploitation is not always given to the actual discoverer of oil. In Algeria, the method of calculating the share of the profits, arising from the exploitation of a concession, that is to be allocated to the State, is based upon the profit made over and above what the capital would have yielded had it been invested in French *rentes*.

TUNIS

INTRODUCTION

Tunis is situated in the northern part of Africa and, with Algeria and Morocco, forms the French zone of influence on the southern Mediterranean Coast. It has an area of 47,000 square miles and a population of 2,100,000, principally Arabs and Bedouins. The transportation and communication facilities include 2500 miles of railway, 3000 miles of wagon roads, and 6000 miles of telegraph and telephone line.

France maintains a protectorate over Tunis, which is administered by a French Resident Governor, cooperating with the native ruler. The Government has operated on a balanced budget for years. The National Debt is estimated at \$69,000,000.

Wheat and grapes are the principal products. The chief exports, in order of their importance, are building stone and minerals, crude metals, and grains; the most important imports are textiles and metal manufactures. France controls the bulk of the foreign trade; Great Britain, Italy, and the United States come next in order.

PETROLEUM RESOURCES

Evidences of petroleum are reported, in formations of Miocene, Eocene, Cretaceous, and Triassic age, in the northern part of Tunis, west of Tebourba, near Testour, and near Biserte. Shallow wells drilled at various points in this district have encountered oil, but so far no commercial results have been obtained.

PETROLEUM LEGISLATION

There is no special petroleum legislation, but the general mining law of the country, contained in the Decree of the Bey dated the 20th of December, 1913, is used. This law provides that mines are the property of the State. An exclusive exploration permit is granted for a period of five years, upon payment of 250 francs. The permit cannot be renewed, but it entitles the owner to the privilege of obtaining an exploitation concession. The Government receives a royalty of 5 per cent of the net production.

FRENCH EQUATORIAL AFRICA**INTRODUCTION**

French Equatorial Africa borders on the Atlantic Ocean, between Cameroon and Belgian Congo, and extends into the heart of Africa. It includes the Colonies of Gabun, Middle Congo, Ubangi-Shari, and Chad, with an aggregate area of about 1,000,000 square miles and a native negro population estimated at 9,000,000. The Central African telegraph line connects Brazzaville with Loango on the coast, and a railway 500 miles in length is under construction between Brazzaville and the Atlantic.

Each colony is administered by a Lieutenant Governor, responsible to the Governor General at Brazzaville, who is appointed by the French Government. The Colony has a balanced budget and no National Debt.

India rubber is the chief export, with palm oil second in value. France controls about 35 per cent of the trade.

PETROLEUM RESOURCES

There are indications of petroleum in Gabun, in the Fernand Vaz District; farther inland, on the Nguni and Ogowai River and on the Island of Saint Thomas, about 200 miles off the coast.

PETROLEUM LEGISLATION

It is possible to obtain exploration authorizations for large areas and exploitation authorizations for smaller areas. A yearly

royalty, varying from one-tenth of a franc to 2 francs per hectare, and a tax ad valorem on exploitation, with a rate not exceeding 5 per cent, are payable to the Government.

MADAGASCAR

INTRODUCTION

Madagascar lies off the southeast coast of Africa, from which it is separated by the Mozambique Channel. The island is 980 miles long and has an average width of 235 miles, making a total area of about 230,000 square miles. The population numbers about 3,500,000, principally natives. Transportation and communication facilities include about 1600 miles of macadamized roads, 776 miles of railway, and 6000 miles of telegraph and telephone lines.

Madagascar became a French Colony in 1896, and is now governed by a Council of Administration and by provincial native governors. The government of the colony has a balanced budget and a National Debt estimated at \$20,000,000, which has been incurred mainly in the construction of public works.

Cattle-breeding and agriculture are the principal occupations of the natives. Manioc and rice are the staple agriculture products. The balance of trade is in favor of Madagascar. The exports, in order of their importance, are hides, rice, and rafia fibre; the chief imports are cotton goods and clothing.

PETROLEUM RESOURCES

Petroleum indications are reported in the western part of the island on the Ankovandra Coast, and in the valleys of the Ranobe and Manambolo Rivers. The oil is found as seepages, or as bitumen in the form of impregnations in Liassic sandstones. In the Ankovandra region the deposits are Eocene, while in the river valleys the rocks are of various Mesozoic horizons. Some exploration work has been undertaken and shallow wells have

been drilled and bituminous sands mined, but so far results have had no commercial value.

PETROLEUM LEGISLATION

The petroleum legislation of Madagascar comes under the Decree of the 20th of July, 1897. This law provides that the ownership of the subsoil is distinct from that of the surface.

Exploration rights are granted for a period of two years, by the Government.

Exploitation concessions are granted for a period of fifty years. A yearly rental and a tax ad valorem on the production must be paid to the State. These rights are granted only to French companies.

NEW CALEDONIA

INTRODUCTION

The French possession of New Caledonia is a hilly island about 800 miles east of Australia. It has a length of about 250 miles; an area of about 7500 square miles; and a population estimated at 50,000, half of which are Europeans, and the balance Melanese and Polynesians. Transportation facilities include a 20-mile railway from Noumea to Paita, now in operation, and an extension to Bouraie, 70 miles distant, which is under construction. There are 1400 miles of telegraph and telephone lines.

Government is administered by a French Resident Governor assisted by a Council.

New Caledonia is rich in minerals, including nickel, chrome, and manganese, which are the chief exports; wines and coal are the chief imports. The chief agricultural crops are coffee and copra. Fifty per cent of the foreign trade is carried on with France.

PETROLEUM RESOURCES

Traces of petroleum occur in thermal springs at Koumac on the northwest coast, between Tounerre Point and Cape Dewerd; these springs rise in magnesian schists of Silurian age, traversed

by intrusive masses of serpentine and diorite. The oil has a gravity of 20.5° Bé. (0.93 sp. gr.).

PETROLEUM LEGISLATION

The French colony of New Caledonia has followed the example of Australia and has made frequent alterations in its mining legislation in recent years. At present the mining industry seems to be regulated by a decree which combines the old law of the Colony with that of France. A somewhat special feature of the law provides that if mines are not being actively worked they are to pay a tax of 10 francs per hectare, instead of the usual tax of 3 francs per hectare payable by mines that are being actively worked.

SYRIA

INTRODUCTION

The French Mandate of Syria is situated in Asia Minor and extends from the Mediterranean and Palestine on the west to Mesopotamia on the east. It has an area of 60,000 square miles and a population of 3,000,000, the bulk of which is of Arabic origin. Arabic is the prevailing language. Rail transportation facilities consist of about 1000 miles of lines, in which are included 190 miles of the Baghdad Railway.

By the Treaty of Peace with Turkey, in 1920, Syria became an independent State under the mandate of France. The Government is under the supervision of a High Commissioner who represents the French Foreign Office. The country has incurred no foreign debt.

The chief products of Syria are wheat and the white mulberry used for feeding silkworms. Raw silk and cocoons constitute the main export; sheep, goats, and cattle are next in importance. The principal imports are cotton goods, steel and iron manufactures, and sugar. The foreign trade is carried on with Great

Britain, France, Egypt, and Turkey. Great Britain supplies about 25 per cent of the imports and purchases 20 per cent of the exports. Imports are valued at \$35,000,000 a year and exports at \$18,000,000.

PETROLEUM RESOURCES

Important asphalt deposits are found in cretaceous limestones near the eastern end of the Dead Sea and in the eastern Jordan Valley. The chief localities are Wadi, Nahawat, Shebba, and Nebi Musa in the Dead Sea region, and Habeya in the Jordan Valley. Indications of less importance are reported near Latakia and Alexandrette on the Mediterranean Sea.

PETROLEUM LEGISLATION

The oil resources of Syria are controlled by the French Government, and concessions for exploration and exploitation are obtained through that Government.

FRENCH GUIANA

INTRODUCTION

French Guiana lies in the northern part of South America and adjoins Dutch Guiana on the west; it has an area of about 32,000 square miles and a population estimated at 50,000. The official language is French. The land rises gradually from the low coast, to the hills about 50 miles inland. The climate is tropical, with a very heavy rainfall; the two rainy seasons extend from May to August and from November to February. Transportation facilities include over 20 navigable rivers emptying into the Atlantic Ocean, and one short railroad controlled by the Penal Settlement.

The colony is administered by a Governor, appointed by the French Government; a Council General for local legislation and a Deputy to the French Parliament are elected by the French

citizens of the colony. Budget deficits are made up by subventions from France. There is no National Debt.

Mining, carried on by convict labor, is the most important industry. Gold accounts for about 90 per cent of the exports, which go to France and Switzerland.

PETROLEUM RESOURCES

Oil seepages are reported in the western part of French Guiana southeast of the Marowijne River, and are supposed to be a continuation of similar deposits in Dutch Guiana. No development work has been undertaken.

PETROLEUM LEGISLATION

It is possible to obtain exploration authorizations for large areas and exploitation authorizations for smaller areas. A yearly royalty, varying from 4 to 75 francs per hectare, and a tax ad valorem on exploitation, with a rate between 1 and 6 per cent, are payable to the Government.

PORTUGUESE POSSESSIONS

PORTUGAL

INTRODUCTION

Portugal is situated in the extreme southwestern part of Europe, and with Spain, it forms the Iberian Peninsula. It has an area of 36,000 square miles and a population of 6,000,000. The transportation and communication facilities of the country include 2000 miles of railroad and 6000 miles of telegraph lines.

Since 1910, when the monarchy was overthrown, Portugal has had a republican form of government. The President, who is elected by Parliament for four years, may not be re-elected. The budget deficit for 1922 is estimated at \$265,000,000 and the National Debt at \$1,880,000,000.

Twenty-six per cent of the area of Portugal is used for the cultivation of cereals and for pasture land. The chief exports, in order of their importance, are raw hides, sardines, and cork; the chief imports are coal, codfish, rubber, and cotton.

PETROLEUM RESOURCES

Petroleum indications are found at Sacario, 4 miles north of Cintra, at Villa Franca, at Meca, at Sacavem near Torres Vedras which is 30 miles north of Lisbon, and at Monta Redonda. These indications are found in rocks of Cretaceous, Jurassic, and Triassic age and are associated with igneous intrusions. Several wells drilled near Torres Vedras failed to disclose oil reservoirs of commercial importance.

PETROLEUM LEGISLATION

The State is the owner of the subsoil of oil, but prospecting may be done without a license and without regard to nationality. After the discovery of oil, the discoverer is granted exclusive prospecting rights within a radius of 707 meters, for a period of one year. "Discovery rights" are granted for areas not exceeding 100 acres per claim. At any time during the following six months, the discoverer may apply for a perpetual concession which will be given if he proves to the satisfaction of the authorities that the property will be operated with ample capital and skill. If the discoverer is unable to do this, the claim is offered to the highest bidder. The concessionaire must deposit a guarantee of 40,000 reis and pay an annual tax of 300 reis and 2 per cent of the gross value of the product.

PORTUGUESE WEST AFRICA**(ANGOLA)****INTRODUCTION**

The Portuguese Colony of Angola, along the west coast of Africa, has an area of about 450,000 square miles and a population of 4,000,000. Transportation facilities include over 800 miles of railroad radiating from the capital at Loanda.

This colony, which has been under Portuguese control since 1575, is divided into eleven districts and is governed by a High Commissioner appointed by the central Government in Portugal.

Coffee and rubber are exported in large quantities. The trade is largely with Portugal.

PETROLEUM RESOURCES

Indications of petroleum are found for 250 miles along the coast, from Lobito Harbor to Port Alexander. The deposits at Dande, north of Loanda, are very important, and great hopes are entertained of ultimate success in their exploitation.

PETROLEUM LEGISLATION

A five-year concession for exploration, with the privilege of renewal, has been granted to a Portuguese company, financed by American interests. The concession provides for the exploitation rights of all petroleum deposits discovered within the exploration period. The building of a refinery in Angola is stipulated.

PORTUGUESE EAST AFRICA**(MOZAMBIQUE)****INTRODUCTION**

Mozambique, situated in the southeastern part of Africa, has an area of over 400,000 square miles and a population of about 3,000,000. Transportation and communication facilities include almost 600 miles of railroad and 3000 miles of telegraph line. River transportation is also used extensively.

It is a Portuguese colony divided into three districts—Mozambique, Mocambique, and Nyasa. The first is ruled by a High Commissioner, the other two by companies which have royal charters granting sovereign rights until 1941.

The chief products are sugar, coconuts, beeswax, and mining products.

PETROLEUM RESOURCES

Important petroleum deposits are reported between Beira and Chinde, near the Zambesi Railroad, where prospective drilling is being done.

PETROLEUM LEGISLATION

The development of the oil resources of the colony is governed by the same regulations that control the development in Portugal.

BELGIAN CONGO

INTRODUCTION

Belgian Congo lies in the central part of Africa and includes the original territory of the Belgian Congo and the districts of Ruanda and Urandi, formerly part of German East Africa. It has an area of about 900,000 square miles, and a population estimated at 11,000,000, of Bantu origin. The native languages comprise many dialects. The country has a coastline of about 25 miles on the Atlantic Ocean, north and south of the Congo River which is navigable for a distance of 93 miles to Matadi. From Matadi to Leopoldville, numerous rapids render the river impassable; but above this point it is again navigable for over 1000 miles. The length of railways is about 2500 miles. A line from Matadi to Leopoldville, and two sections of the Cape-to-Cairo Railroad, are included in the system.

The "Congo Independent State" was founded in 1885 by the Belgian King, who is represented in the colony by a Governor General. The Government expenditures usually exceed the revenues; the National Debt is estimated at \$67,000,000.

The value of exports exceeds that of imports. The chief exports, in order of their importance, are copper, palm-nuts, copal, and ivory; the imports are cottons, wines and beer, and provisions. Belgium controls 88 per cent of the foreign trade.

PETROLEUM RESOURCES

Bituminous shales of Permian-Triassic age are reported near Stanley Falls on the Congo River, between Stanleyville and Ponthierville; other deposits are reported on the shores of Lake

Albert and along the northern shores of Lake Tanganyika. All these are in the interior of the country.

PETROLEUM LEGISLATION

Exploration rights are granted by the local authorities, subject to the approval of the King of Belgium. After notifying the authorities of the discovery of oil, the discoverer has the right, within six months, to claim for exploitation a concession tract not exceeding 250,000 acres for ninety-nine years, upon payment of \$500 and 40 cents per acre. A royalty of 5 per cent of the net profits must be paid to the Government. There are no restrictions as to nationality.

DUTCH GUIANA

INTRODUCTION

Dutch Guiana lies in the northern part of South America, between British and French Guiana. It has an area of about 46,000 square miles and a population estimated at 113,000, exclusive of forest Indians and negroes. Dutch is the official language, but English is generally used. The coastal districts are low, but inland the country gradually ascends to densely wooded hills. The climate is moist and tropical; there are two rainy seasons, one from April to August, the other from November to February. Inland transportation is dependent on the rivers, which are deep and navigable by seagoing vessels for a considerable distance inland. There are about 90 miles of railroads.

In 1667, the colony was ceded to Holland by England, in exchange for the colony of New Amsterdam, now New York. The Governor is appointed by the Queen. As the colony is not self-supporting, the Dutch Government assists with subventions.

Sugar, cocoa, rum, and gold are the chief exports; textiles, meats, cheese, and coal are the chief imports. Foreign trade is carried on chiefly with Holland, British and French Guiana, and the United States.

PETROLEUM RESOURCES

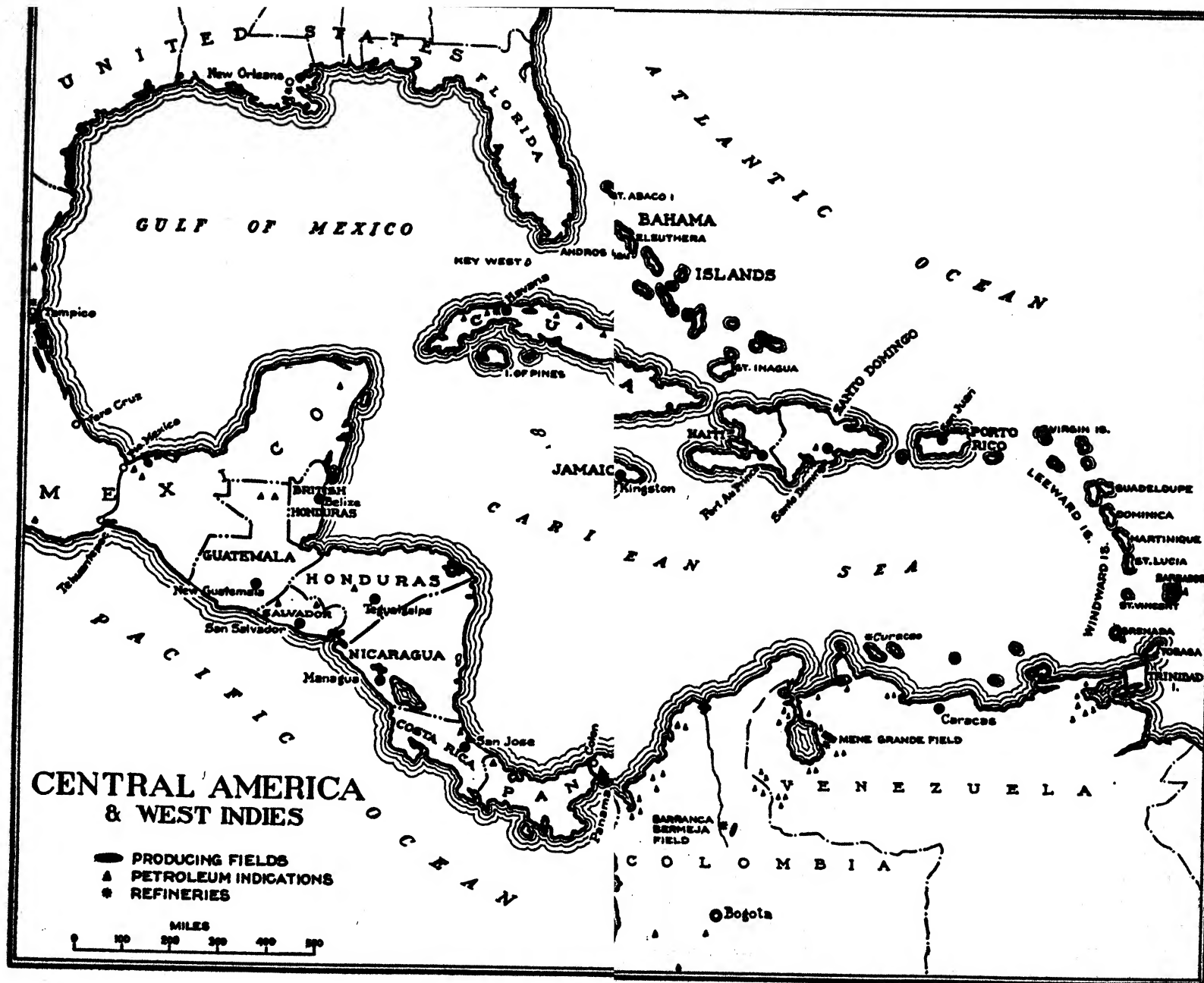
Petroleum indications are reported as oil seepages in the northeastern part of the country on the Surinam River, 6 miles from Kabele, and on the Marowijne River, about 100 miles from Albina. A concession covering 1700 acres in the region of the

Surinam River has been issued, but no development work has yet been undertaken.

PETROLEUM LEGISLATION

A legislative policy similar to that of the Dutch East Indies is in effect. The Government retains a controlling interest in all oil lands.

The Governor of Dutch Guiana has certain discretionary powers in granting exploration and exploitation concessions on a rental and royalty basis.



GUATEMALA

INTRODUCTION

The Republic of Guatemala is situated in the northern part of Central America, just south of Mexico. It has an area of 48,000 square miles and a population of about 2,000,000, 60 per cent Indians and 40 per cent of mixed races. Transportation facilities include 450 miles of railroad and 3400 miles of wagon roads, less than half of which can be used during the rainy season, which runs from May to October. There are also about 1000 miles of trails, which are used by oxcarts and mules, and approximately 5000 miles of telegraph and telephone lines, owned and operated by the Government.

The republican Government was established in 1847. The President, who is elected for a term of six years, may be re-elected. The revenues of Guatemala have been subject to yearly fluctuations, paralleling the changes in the market price of coffee, which is the chief source of income. They reached \$3,500,000 in 1916 and 1918. Expenditures have likewise varied, but until 1921 the budget of the country showed a surplus of revenue over expenses. In 1921 the National Debt of the country was estimated at \$18,000,000.

Exports aggregate in value from \$10,000,000 to \$20,000,000, of which coffee represents about 90 per cent; sugar and bananas are second and third in importance. In 1921 the country experienced a great commercial depression, due to the decline in the price of coffee, from which she has been gradually recovering. The bulk of Guatemala's foreign trade, both export and import, has been with the United States, but recently there has been a decline, with a corresponding increase in European trade.

PETROLEUM RESOURCES

No petroleum production has yet been developed in Guatemala, nor has the country been thoroughly prospected for oil; but oil seepages are reported in a number of places, particularly near the Mexican border in the provinces of San Marco and Huehuetenango. Reconnaissance surveys have been undertaken, but no development work has been done or is expected in the near future.

Should commercial quantities of oil be discovered near the Mexican border, it may be necessary, owing to topographic conditions, to export the oil through the navigable Mexican rivers or through British Honduras.

PETROLEUM LEGISLATION

By the law of the 3d of June, 1922, which was amended on the 21st of September, 1922, the nation retains the ownership of the underground resources of petroleum, and the oil industry is declared to be a public utility.

Any person may obtain a license to carry on simple explorations on unclaimed lands for a period of one year, free of charge, and may also obtain a license for exclusive exploration for a term of three to five years, covering an area of 10,000 to 200,000 hectares. Such lands must be surveyed and are subject to an annual tax of 5 cents per hectare. The license, when granted, includes exploitation rights. Drilling operations must begin during the first half of the period allowed for exploration.

Exploitation contracts are for thirty years. The Government will then auction rights to the highest bidder. The new owner must reimburse the old owner for installations, if he desires to retain them. Drilling a commercial well, or one to a depth of 500 meters, must be done within two and one-half to four years. Work may not be suspended for more than six months.

A royalty of 10 to 12 per cent of gross production must be paid to the Government, and 1 per cent to the surface owner. The Government or private owner has the privilege of taking the

royalty at the mouth of the well, at the shipping port, or in money at the current market price in New York, less the cost of transportation.

Private landowners are entitled to an indemnity for the use of surface, and damages where incurred. The owner may refuse indemnity payments and may receive instead 2 per cent of the gross products.

All machinery and construction materials may be imported free of duty.

A foreigner must agree to be governed by the laws of the country and not to appeal to his own country through diplomatic channels. He must also prove that his own country does not deny to citizens of Guatemala similar privileges to the ones contained herein.

HONDURAS

INTRODUCTION

The Republic of Honduras is one of the Central American countries bordering on the Caribbean Sea. It has an area of 46,200 square miles and a population estimated at 650,000, chiefly Indians with an admixture of Spanish blood. The official language is Spanish. The country is mountainous and well watered and has a climate that is generally warm and healthful, with a rainy season from May to October. Although there are about 460 miles of railroad in Honduras, transportation is usually conducted by ox-carts and mules. The Government owns and operates about 5500 miles of telegraph and telephone lines.

Honduras was formerly a Spanish possession, but in 1821 an independent republic was established. The President, who is elected for four years, may not be re-elected for successive terms. For a number of years Government expenditures have exceeded revenues; in 1919-1920, the revenues reached \$5,000,000, which is the highest figure on record. The National Debt, exclusive of interest which has not been paid since 1872, is estimated at \$30,000,000.

Agriculture is the principal industry, and bananas are the chief product and export; they represent about 40 per cent of the total; sugar and coconuts are other important products. The United States purchases 95 per cent of the exports and furnishes the bulk of the imports.

PETROLEUM RESOURCES

Although indications of petroleum have been reported in northern Honduras, in the departments of Atlantida and Yoro,

at several localities, it has been ascertained that these so-called seepages have no relation to the occurrence of petroleum. Oil indications are also reported northwest of Tegucigalpa, in the Guare Mountains. During 1921 and 1922 the oil possibilities of the vast region in the northern part of the country were investigated, with negative results, by European petroleum interests. The enterprise has since been abandoned.

PETROLEUM LEGISLATION

Honduras has no special petroleum legislation, nor does the mining code of 1895 specifically refer to petroleum. The Government, however, has been granting concessions for the exploration and exploitation of petroleum resources, based on some of the provisions of the mining code. This provides that the right to explore in public or private lands in search of mines may be freely exercised in unfenced, uncultivated, and unimproved property. The consent of the owners is necessary before the land may be improved; but if the owner fails to give consent, permission from a judge may be obtained for a period of sixty days.

The Government granted an exploitation concession in April, 1919, for the Departments of Tegucigalpa, Olancho, Chuleta, Valle, El Paraiso, and the territory of Mosquitia, which contains the following provisions:

Concessionaires have the right, for a period of twenty-five years, to drill for oil in the above Departments, unless the Government makes similar contracts with other parties. An exclusive right is granted for an area of 1600 hectares for each producing well brought in.

Drilling equivalent to 2000 meters must be completed within the first two years. The Government is entitled to 10 per cent of the gross production at the mouth of the well or at shipping terminals, and a bonus of \$10,000. The concession may be transferred to a third party with the consent of the Government. Construction material and machinery may be imported free of duty.

SALVADOR

INTRODUCTION

The Republic of Salvador is the smallest and most densely populated of the Central American nations. It has an area of 7000 square miles, and a population of 1,500,000, of mixed Spanish and Indian blood. Spanish is the official language. The climate varies from the tropical heat of the Pacific Coast to the pleasant coolness of the interior mountain regions; the rainy season extends from May to October, with the heaviest rainfall in September and October. Two mountain chains traverse the country and enclose valleys of great fertility; violent earthquakes are of frequent occurrence. Salvador has no eastern coastline, but may be entered from the east through Guatemala; shipping, however, is limited to the Pacific. The wagon roads of Salvador are in better condition than in other Central American countries and are passable even in the rainy season. There are 213 miles of railroad and 3600 miles of telegraph and telephone lines.

The executive power of the Republic is vested in a President, who is elected for four years, without the right of re-election. As a rule, the expenditures of Salvador have exceeded the revenues, but this situation is of late improving; the National Debt is estimated at \$18,000,000.

The most important export of the Republic is coffee; indigo and sugar rank next in importance. The United States purchases 55 per cent of the exports and furnishes most of the imports, of which cotton is most important.

PETROLEUM RESOURCES

The information regarding the existence of prospective oil fields is very meager, but petroleum indications have been reported

in connection with the drilling of water wells in the district of Antiquisaya, and in Carolina, north of San Miguel. However, no co-ordinated effort has been made to study the oil possibilities of the country, and no conclusion as to their probable value is justified.

PETROLEUM LEGISLATION

The most recent mining law of Salvador, under date of the 17th of May, 1922, provides that the ownership of the subsoil is vested in the Nation and Chief Executive, and that the surface owner has no priority rights. The oil industry is considered a public utility. Foreign individuals and companies may obtain concessions by subjecting themselves to the laws of the country and by establishing a domicile with a legal representative in the Capital. They may not transfer their concessions without the consent of the Executive.

Rights of exploration and exploitation are obtained by special concessions from the President, and permission to start exploration work is obtained from the Governor. The time limit, area, work requirements, royalty, taxes, etc., will be fixed by the Executive for each concession, as may best suit the interest of the nation. The discoverer of the oil has the first right to his concession, but he must indemnify the property owner for the surface which he may occupy or damage

COSTA RICA

INTRODUCTION

The Central American Republic of Costa Rica has an area of 23,000 square miles and a population of 470,000, with a larger proportion of Spanish blood than in other Central American countries. One of the pressing needs of the country is an increased population. The official language is Spanish. The country is generally mountainous, and the climate is mild, with a rainy season from May to November. The Atlantic slopes are covered with dense forests, while large stretches of fertile plains distinguish the Pacific Coast. Transportation and communication facilities include 400 miles of railroad and 3200 miles of telegraph and telephone lines owned and operated by the Government.

The Republic was established in 1821. The President is elected for a term of four years, and re-election, contrary to the custom of other Spanish-American countries, has occurred only once in thirty years. For a number of years, Government expenditures have exceeded revenues, with a decreasing difference each year. The National Debt is estimated at \$30,000,000.

Agriculture is the principal industry, with coffee as the chief product; gold and silver mining along the Pacific Coast is the second industry. Coffee is also the chief export; bananas, sugar, gold, and silver come next in importance. The United States purchases about 71 per cent of the exports and furnishes 52 per cent of the imports, chiefly flour and cotton goods.

PETROLEUM RESOURCES

Two test wells are reported to have been started by one of the large American oil companies, near Limon, on the Amei River, where seepages of oil are numerous; but development has been

temporarily suspended pending the settlement of certain matters between the Government and the company. It is confidently expected that these difficulties will be finally arranged. The Amei River District is about 300 miles from the Panama Canal.

PETROLEUM LEGISLATION

The petroleum legislation under date of the 24th of November, 1922, provides for the national ownership of the subsoil.

Exploration rights are granted for a period of three years, for an area of 100,000 hectares.

Exploitation rights are granted for twenty-five years, for the area explored. A guarantee deposit of \$35,000 in cash or property, and a yearly rental of 50,000 colones for each 100,000 hectares, must be paid to the Government.

In private lands, the owner receives a royalty of 5 per cent, the State 5 per cent, and the local district $2\frac{1}{2}$ per cent.

PANAMA

INTRODUCTION

The Republic of Panama is situated in the extreme southern part of Central America. It has an area of 31,900 square miles (exclusive of the zone belonging to the United States, which has a width of 5 miles on either side of the canal), and a population of 401,000, comprising whites of Spanish extraction and negroes. The country has a tropical climate, with a rainy season extending from May to December; the heaviest rains come along the eastern coast, during October and November. Transportation facilities outside of the Canal Zone are very primitive, including only about 180 miles of railroad.

Panama has been an independent republic since 1903, when it seceded from Colombia. The President is elected for four years and is not eligible for the succeeding term. For a number of years, expenditures have exceeded revenues; but since the financial reorganization under the supervision of the United States, the situation has improved. The National Debt is estimated at \$3,000,000.

The chief exports are bananas and coconuts; the chief imports are textiles and machinery. The United States purchases about 90 per cent of the exports and furnishes 76 per cent of the imports.

PETROLEUM RESOURCES

Oil seepages occur on the Pacific Coast, at Garachine on San Miguel Bay; and on the Atlantic, at Bocas del Toro, where test drilling by American interests is under way, under the terms of a Government concession.

PETROLEUM LEGISLATION

The Nation reserves the right to exploit petroleum deposits and is the owner of the subsoil. Foreigners have the same rights as natives in the development of the oil resources.

Rights of exploration were obtained, prior to January, 1917, for a term of three years for an area of 25 hectares, upon payment of one balboa per hectare.

Upon developing a minimum of $6\frac{1}{2}$ barrels of oil or 350 cu. ft. of gas per day, rights of exploitation were obtained, through Government contracts for a period of twenty years, with the privilege of renewal for twenty more. No rental nor drilling obligations were incurred, but a royalty of 5 per cent of the gross products, or 10 per cent of the net profits, was paid to the State.

On private land, the owner of the surface had the right to exploit the land upon payment to the discoverer of 10 per cent of the net proceeds, or the discoverer might exploit the land upon payment to the owner of 20 per cent of the net proceeds.

These provisions were changed by the law of July, 1917, when exploration rights were reduced to one year, and the exploitation term to ten years with a ten-year renewal; the Government receives 5 per cent of the gross products. It will be seen that, contrary to the general trend of other Spanish-American petroleum legislation, Panama has by its law of July, 1917, protected those who acquired concessions prior to that date and has discouraged the subsequent acquisition of rights.

CUBA

INTRODUCTION

The island Republic of Cuba is situated to the southeast of Florida and forms the so-called Key to the Gulf of Mexico. It has an area of 44,000 square miles and a population estimated at 2,900,000, composed of white, mixed, and negro races. The southwestern parts of the island are mountainous and rich in iron and copper. Transportation facilities include 3200 miles of railroad and wagon roads extending across and along the island. There are a number of excellent harbors along the northern and southern coasts.

Cuba became an independent country in 1898, at the end of the Spanish-American War. The President holds office for four years and is eligible for re-election. The United States retains a supervisory interest in the government of the island. For a number of years, Government revenues exceeded expenditures, but in 1920 the sudden rise and fall in the price of sugar caused the country to become practically bankrupt. The National Debt is estimated at \$87,000,000.

Cuba is the first sugar-producing country of the world, and cane sugar is easily the chief export, with tobacco second; the chief imports are foodstuffs. The bulk of the foreign trade is controlled by the United States, which has a protective tariff of 25 per cent.

PETROLEUM RESOURCES

Indications of oil exist in almost every province of the island; the most important localities are in the Province of Pinar del Rio, Havana, Matanzas, and Santa Clara. For many years, shallow

wells near Motembo, 100 miles east of Havana, have produced very small quantities of a light oil with a gravity of 65° Bé. (0.718 sp. gr.). There are also wells at Bacuranao, 15 miles east of Havana, producing larger volumes of heavier oil, which is sold to refineries in Havana. The output of wells has declined rapidly. The accumulation of oil so far discovered is associated with serpentine and sedimentary rocks, and the efforts made to test structures in sedimentary rocks exclusively gave a negative result.

PETROLEUM LEGISLATION

The mining laws of Cuba provide for the national ownership of the subsoil; foreigners have the same rights as natives in the development of the oil resources.

Rights of exploration may be obtained for an unlimited area, not less than 100 acres, by giving notice to the civil authorities.

Rights of exploitation may be obtained after an official survey of the land, by presenting a petition for concession, without limit to the area of the concession. A survey deposit of 2 to 2½ pesos per hectare, a title fee of 1 peso per hectare, an annual concession rental of 2 pesos per hectare, and a royalty of 6 per cent of the gross profits must be paid to the Government. On private lands, the owner of the surface has six months' priority right in which to begin exploitation.

DOMINICAN REPUBLIC

INTRODUCTION

The second largest island in the West Indies is divided into the Republics of Haiti and Santo Domingo. The Dominican Republic occupies the eastern two-thirds of the island, with an area of 19,000 square miles and a population estimated at 895,000, composed mainly of a mixed race of Spanish, negro, and Indian blood. The country is mountainous and has a warm, healthful climate, with heavy rains in the northern and central districts from July to November. Transportation and communication facilities include 400 miles of railroad, 300 miles of telegraph line, and 900 miles of telephone line.

The Dominican Republic has been an independent nation since 1844, when it proclaimed its freedom from Haiti. In 1916, the United States established a military rule, under a Governor who combines the functions of president and congress; in October, 1922, a greater freedom was again granted by the removal of the American authorities. Since 1905, the revenues have been collected by an American agent, and for a number of years have exceeded expenditures. The National Debt has been reduced since 1908 from \$20,000,000 to \$13,000,000.

The chief export is sugar, the receipts from which reached \$70,000,000 in 1920. The United States purchases the bulk of this and supplies the chief imports, which are cotton goods and foodstuffs.

PETROLEUM RESOURCES

Although the information regarding the oil resources of the country is very meager, it is known that some wells have been

drilled in the Azua region, 10 miles west of the town of Santo Domingo, in the southern part of the island. Analysis of the oil obtained in this region shows a gravity of 20° Bé. (0.933 sp. gr.).

PETROLEUM LEGISLATION

The mining laws of the 8th of June and the 27th of July, 1910, provide for the national ownership of the subsoil.

Exploration licenses are acquired from the Government of the Province, previous to the consent of the owner of the land; but in case the owner refuses, the Governor issues the permit on the deposit of a bond which will insure casual damages to the land.

After denouncement is made before the Governor of the province, the Chief Executive of the nation grants exploitation concessions, in which rights-of-way will be included. Such concessions are granted to nationals or foreigners, and the concessionaire is vested with the property of the subsoil. The owner of the land on which the oil is discovered is entitled to a royalty of 1 or 2 per cent of the net profits of the exploitation, and the State to 2 per cent of the gross production.

ECUADOR

INTRODUCTION

The Republic of Ecuador, so named for its equatorial position, is situated in the western part of South America. It has an area of about 116,000 square miles and a population of 1,500,000, with about 20 per cent of Spanish extraction and the balance made up of Quichua and Caras Indians. The country is divided into three topographic sections: the lowlands between the coast and the western base of the Andes, the high plateau between the eastern and western Andes, and the tableland east of the Andes drained by the headwaters of the Amazon River. The season of tropical rains extends from December to May. There are 400 miles of railroad, which are inadequate for the transportation requirements; and because of poor wagon roads, often impassable during the rainy season, interior cargo is carried almost entirely by Indian porters and mules.

Ecuador became an independent republic in 1830, after the dissolution of the "Great Colombia," which included present-day Colombia, Venezuela, and Ecuador. The President, who is elected for a term of four years, cannot be re-elected for the two succeeding terms. For a number of years, Government expenditures have exceeded revenues. The National Debt is estimated at \$28,000,000.

The chief exports are cocoa, which represents two-thirds of the total, and vegetable ivory; the chief imports are textiles and food-stuffs. Approximately 60 per cent of the foreign trade is carried on with the United States.

PETROLEUM RESOURCES

The producing oil fields of Ecuador are located on the peninsula of Santa Elena, 90 miles west of the harbor of Guayaquil. The

present production of about 13 barrels per day is obtained from hand dug wells, 10 to 15 ft. in depth. The oil occurs in steeply dipping shales and in sandstones of late Cretaceous or early Tertiary age associated in places with igneous dikes. North and south of Santa Elena, the Tertiary deposits are not so steeply folded as those to the west. About 5 miles west of Santa Elena, four wells have been drilled, producing a small quantity of oil; and at Ancon, 2 miles west, one well pumps about 10 and another about 27 barrels per day. Additional development is being carried on near the coast, a short distance north of Manta, and at Amen, about 30 miles west of Guayaquil. There are two small refineries at Santa Elena, with a capacity of 16 and 20 barrels per day; the products are sold at Guayaquil.

The gravity of the oil varies from 12° Bé. (0.986 sp. gr.) from the hand-dug wells, to 34° Bé. (0.835 sp. gr.) from those drilled to about 2000 ft.

The prospective areas of Ecuador lie along the coast, near the town of Esmeraldas in the north; in the vicinity of Cuenca in the Province of Del Azuar, in the south; and in the interior of the country along the eastern foothills of the Andes.

PETROLEUM LEGISLATION

The mining laws of Ecuador provide for the national ownership of the subsoil.

Exploration rights may be obtained by foreigners or natives for a period of four years and for an area of 500 to 5000 hectares. A deposit of 100 sucres for each 100 hectares and a bond of 1000 to 5000 sucres is required.

No new contract is necessary for exploitation. The exploration lease is extended for twenty years, with the privilege of renewal. A yearly rental and a royalty of 5 to 12 per cent of the gross production must be paid to the Government, in money or in oil. Concessions may be transferred with Government permission. No taxes are levied on capital, exports, pipe lines, or refining, for a period of twenty years.

It is reported that in May, 1921, American interests contracted with the Government for a concession of 25,000 square kilometers in which to explore and exploit petroleum. In return, the company is to build highways and to drill ten wells.

BOLIVIA

INTRODUCTION

The Republic of Bolivia, situated in the central part of South America, is so named in honor of Simon Bolivar, the great South American liberator. It has an area of approximately 515,000 square miles and a population of 2,890,000, of which Quichua and Aymara Indians form 60 per cent. Although the country lies entirely in the Torrid Zone, it has a variety of climates ranging from the extreme cold of the upper Andes to the tropical heat of the plains. Since Bolivia has no coastline, the railroads are doubly important; transportation and communication facilities include 1400 miles of railroad, 2500 miles of wagon roads, and 4000 miles of telegraph lines. Traffic between interior points is maintained by pack trains of mules and llamas. The foreign trade passes through Chile, Peru, and Argentina.

Bolivia was originally a part of Peru, but became an independent republic in 1825 with the withdrawal of the Spanish rule. The President is elected for four years and is ineligible for successive re-election. Government expenditures have for a number of years exceeded revenues; the National Debt is estimated at \$27,000,000.

Bolivia ranks next after the United States and Mexico as the richest mineral-producing country of America. Tin accounts for 80 per cent of the total exports, with rubber, silver and copper next in importance. Exports have reached as high as \$61,000,000, and imports \$24,000,000. Great Britain controls 50 per cent of the foreign trade, and the United States 40 per cent.

PETROLEUM RESOURCES

There are numerous prospective oil regions in the country that invite careful investigation. North and northwest of the city of Santa Cruz, in central Bolivia, evidences of oil are found in frequent seepages; the oil is bailed out of holes by the natives for local use. The general direction of the fields parallels the main chain of the Andes. Evidences of oil have also been found near the cities of Sucre and La Paz. Some shallow drilling in this region has yielded oil with a gravity of 35° Bé. (0.85 sp. gr.). The seepages are found in strata of Tertiary and Devonian age, with a succession of bituminous shales and micaceous sandstones. . Inadequate transportation is the chief obstacle to the development of the oil resources of Bolivia. American interests have recently obtained Government concessions covering large areas of prospective oil lands in the Santa Cruz and other prospective districts.

PETROLEUM LEGISLATION

Under the Bolivian Petroleum Law of June, 1920, the ownership of the subsoil is vested in the State, but the surface owner has priority rights to the subsoil if his property is fenced. Oil explorations are considered public utilities. Permits for exploration and exploitation are granted regardless of the nationality of the petitioner.

Exploration rights are obtained in the form of permits granted by the President, for a period not exceeding four years and for an area not over 300,000 hectares. A guarantee payment of 10 centavos, and a yearly rental of 2½ centavos for each hectare, are levied. Parcels of land desired for exploitation must be selected within four years.

A concession for exploitation, granted by the President, is given for a period not exceeding fifty-five years, for a maximum area of 100,000 hectares. Concession holders must pay 10 centavos per hectare for the first year, after which the amount increases yearly until the seventh year, when it reaches 50 centavos per hectare.

A maximum royalty of 11 per cent of the gross production, in oil or money, is levied. The Government reserves for itself 20 per cent of the land selected for exploitation. Within four years from the date of the concession, the land must be surveyed and exploitation work begun.

Right of way is gratis, and all pipe lines are considered common carriers. Construction material may be imported free of duty during the life of the company.

BRAZIL

INTRODUCTION

The Republic of Brazil, with an area of about 3,275,000 square miles, is the second largest country on the American Continent. It is bounded by every South American country except Ecuador and Chile. The population is estimated at 30,600,000, composed of white, mixed, Indian, and negro races. The official language is Portuguese. Transportation and communication facilities include 40,000 miles of rivers, navigable by ocean-going steamers, 18,000 miles of railroad, 55,000 miles of telegraph line, and 250,000 miles of telephone line.

Brazil became a Portuguese possession in 1500, when it was discovered by the Portuguese Admiral, Cabral. In 1822, it declared its independence, and Dom Pedro, a son of the Portuguese king, was made Emperor. In 1889, Dom Pedro II was dethroned, and a republic was established under the name of the United States of Brazil. The President, who is elected for four years, is not eligible for re-election. For a number of years, Government expenditures have exceeded revenues, about 60 per cent of which are derived from import duties on foreign goods. The National Debt is estimated at \$969,000,000.

Brazil produces 75 per cent of the world's coffee. The chief exports, in order of their importance, are coffee, animal products, and sugar; they are purchased principally by the United States, France, and Great Britain. The chief imports are textiles, machinery, and coal; they are furnished by the United States, Great Britain, and Argentina.

PETROLEUM RESOURCES

The prospective oil fields of Brazil are located along the western frontier, in the upper Amazon Valley near the Peruvian

border; and along the eastern coast, south of the mouth of the Amazon, in the states of Maranhao, Alagoas, Bahia, São Paulo, Parana, and Rio Grande do Sul.

The possibilities of petroleum in the upper Amazon Valley are considered important, because of the geological similarity of this region to the neighboring prospective oil areas of Colombia, Peru, and Venezuela.

Oil shales occur along the eastern coast at various points, extending from Taubate in the south, about 150 miles southwest of Rio de Janeiro, to Maceio in the north, about 300 miles northeast of Bahia. The most promising are those near Marahu and Caravellas, 110 and 230 miles south of Bahia.

PETROLEUM LEGISLATION

The subsoil constitutes a real property, which is alienable independently of the soil. Although oil is not a national property, its ownership begins with its discovery.

The owner of the soil has the right to prospect for oil and to exploit it without restrictions, if he discovers it. Third parties are not allowed to prospect on private lands, except with the consent of the owner. The owner of the subsoil is given a year in which to prospect; if he fails, other prospectors are entitled to a prospect license. It is understood that the owner of the soil shall receive indemnity for his property, or a percentage of the net profit of exploitation.

For prospecting public lands, a license must be acquired from the Minister of Agriculture, Industry, and Commerce; and after oil is discovered, the Government grants a concession which entitles the grantee to the subsoil, as well as to the soil which he may find in the land comprised in his grant.

Foreigners have the same rights as natives, but companies organized under the laws of the country enjoy certain privileges.

CHILE

INTRODUCTION

The Republic of Chile extends for nearly 2700 miles along the western coast of South America, with an average width of 107 miles. It has an area of about 290,000 square miles and a population of 3,755,000, about 1,000,000 of Spanish extraction and the balance of native Indian or mixed races. The country is divided into three sections: the deserts of the north, the arable lands of the central part, and the forests of the south. There is a rapid transition from the coastal plains to the backbone of the Andes less than 100 miles to the east. Chile ranks with the Argentine Republic in the excellence of her transportation and communication facilities, which include 5000 miles of railroad, 22,000 miles of wagon roads, and 70,000 miles of telegraph and telephone lines, partly owned by the Government. The irregular coastline forms excellent harbors.

Chile declared her independence of Spain in 1810, but the Republic was not established until 1818. The President, who is elected for five years, is not eligible for successive re-election. The bulk of the revenues comes from the export tax on nitrates; and, previous to the end of the World War, when nitrate for the manufacture of explosives was in great demand, the Government revenues exceeded expenditures. Since 1919, when the demand for nitrates noticeably decreased, the revenues have not covered expenditures. The National Debt is estimated at \$258,000,000.

Nitrate is the chief export, with copper, wheat, and barley next in importance. The chief imports are textiles and machinery. The bulk of the foreign trade is carried on with Europe; railroad supplies come from the United States.

PETROLEUM RESOURCES

Oil indications have been observed in the northern part of Chile, in the Province of Tarapaca, south of Patillos; in the central part, about 60 miles east of Coquimbo, at an elevation of about 11,000 ft.; in the south central part, in the province of Llanquihue, south of the Maullin River; and in the extreme southern part, near the Straits of Magellan, at Punta Arenas, Puerto Porvenir, and Agua Fresca. The seepages east of Coquimbo were manifested as the result of an earthquake. The sedimentary formations are of Devonian and Cretaceous age. Some prospective work is going on in the Punta Arenas, where the geologic conditions seem favorable for the occurrence of petroleum.

PETROLEUM LEGISLATION

The Republic of Chile has no petroleum legislation. The oil industry is governed by the Mining Code of the 1st of January, 1889, which provides that the subsoil belongs to the State and surface owners have no priority rights.

Exploration work may be carried on freely, by both nationals and foreigners, without permits, except on improved property, where the consent of the owner is necessary.

Exploitation work may be started by staking out and registering claims of 50 hectares each. As many as three claims may be staked out in the territory, outside of a radius of 5 kilometers from other claims, which would be considered virgin territory. By the ratification, manifestation, registration, and completion of survey by judicial order, exclusive title is acquired to the subsoil within the boundaries of the claim.

The discoverer of minerals has exclusive rights, within fifty days after registering his claim, to stake out new claims within a radius of 5 kilometers, third parties after one hundred and eighty days. A rental of 5 pesos per hectare per year must be paid to the Government. All rights may be freely transferred, and no restrictions are placed upon the exploitation of minerals.

SPAIN

INTRODUCTION

Spain, with Portugal, forms the Iberian Peninsula, in the extreme southwestern part of Europe, and is separated from France by the Pyrenees Mountains. It has an area of about 190,000 square miles, made up of a high central plateau and an eastern and southern coast belt, with a climate tempered by the warm Mediterranean winds. The population is estimated at 20,000,000, including native Spaniards, and about 400,000 Basques in the north who differ in race and language from the Spaniards, 50,000 gypsies, and a very small number of Jews. Spanish is spoken throughout the country. Transportation and communication facilities include many good harbors, about 9000 miles of railway in excellent condition, 46,000 miles of good wagon roads, and 71,000 miles of telegraph lines.

The Spanish Monarchy was founded by the union of the crowns of Aragon and Castile, in 1479. The present constitution, proclaimed in 1876, provides for a limited monarchy with executive power vested in the King and a Council of Ministers. For a number of years, the government expenditures, aggregating about \$510,000,000, have exceeded the revenues, which are about \$400,000,000. The National Debt is estimated at \$2,335,000,000.

Spain is an agricultural country; 25 per cent of the inhabitants are engaged in agricultural pursuits. Grapes, olives, oranges, and grains are raised in large quantities. The hydro-electric plants located in northeastern Spain supplying power to many factories are the largest in Europe. The quicksilver and iron mines of Spain are among the most important in the world. The bulk of Spain's foreign trade is carried on with France, Great Britain, and the United States. Exports are valued at

\$175,000,000, imports at \$250,000,000. The principal exports, in order of their importance, are wine, oranges, and grains; machinery and textiles are the principal imports.

PETROLEUM RESOURCES

There are numerous surface indications of petroleum, and a limited number of asphalt and bituminous shale deposits, which are being exploited in a primitive manner.

In southern Spain, petroleum indications exist in the Province of Cadiz, along the Guadalquivir and Guadalete Rivers, at Barbate, Rota, Conil, and Villamartin. Some unsuccessful drilling has been carried on at Acras, Chilana, Conil, and Villamartin. The petroleum which is recovered in small quantities at Conil has a gravity of 38° Bé. (0.83 sp. gr.).

Bituminous marls are found in the Province of Malaga near Ronda, and at Rubielos between Teruel and Castellon.

In the north, in the eastern part of the Spanish Pyrenees, near Catalonia, frequent indications of petroleum are found. Between the Pyrenees and the high plateau in the Cantabrian Mountains other indications have been reported. Here they are especially abundant in the Provinces of Santander, Burgos, Alava, Soria, and Oviedo; a well in the last-named province encountered a considerable flow of gas. The Government is planning to drill at Haldeo, in the Province of Burgos, on the Bilbao-Robla Railroad; and at Munguia in the Province of Vizcaya.

PETROLEUM LEGISLATION

The petroleum laws of Spain are embodied in the revised mining code of the 29th of December, 1868, and in its amendments. This law provides for the State ownership of the subsoil and makes the mining of petroleum a public utility.

Exploration work, not exceeding a depth of 10 meters, may be carried on without special license upon public lands; but local authorities must first be notified. On private property, the

consent of the owner is required. Companies exploring for oil are exempt from taxes on land being explored.

Land for exploitation may be obtained by virtue of Government concessions. The mining unit is a *pertenencia*, with an area 100 meters square, and a concession may contain not less than 4 *pertenencias*. The time limit of a concession is dependent only upon the payment of the annual rental of 6 pesetas per hectare. For each concession consisting of 20 *pertenencias* or less, an initial deposit of 150 pesetas is required; this diminishes as the area increases, until a deposit of 2 pesetas per *pertenencia* is made for concessions covering more than 500 *pertenencias*. A title is absolutely necessary to dispose of products, and this may be obtained by denouncement, registration, and survey; work may be started after the period allowed for opposition. A royalty of 3 per cent of the gross products must be paid to the Government.

A decree issued on the 15th of June, 1921, provides that concessions may only be granted or conveyed to Spaniards or companies organized and domiciled in Spain. In the latter case, only one-third of the offices may be held by foreigners. All construction materials must be of Spanish manufacture, but foreign material may be imported if not manufactured in Spain.

CZECHOSLOVAKIA

INTRODUCTION

The Czechoslovak Republic includes the provinces of Bohemia, Moravia, Slovakia, Silesia, and Ruthenia, which formerly were combined with Austria-Hungary. It has an area of about 54,300 square miles and forms an irregular belt approximately 543 miles long by 100 wide, which extends east and west in the interior of Central Europe. The population numbers about 13,600,000, of which 6,000,000 are Czechs, 3,700,000 Germans, and 1,700,000 Slovaks. Czech dialects are most commonly used. The country is dependent for her water transportation on the Danube, which flows into the Black Sea, and on the Elbe, emptying into the North Sea. There are 8500 miles of railroad, partly owned by the Government.

In 1562, Czechoslovakia became a part of the Austro-Hungarian Empire, but, by the treaty of Versailles, in 1918, a republican government was established. The President is elected by the National Assembly for a term of seven years. Czechoslovakia is perhaps the most stable and industrious of the new countries created by the War. The budget deficit for 1922 is estimated at \$756,000,000; the National Debt, including a share of Austria-Hungary's pre-war debt, is approximately \$9,135,000,000.

Agriculture and mining are the chief industries; wheat, sugar, beets, timber, and coal are the principal products. The main articles of export, in order of their importance, are glass, sugar, timber, and coal; the chief imports are cotton, textiles, and cereals. The value of exports and imports is about equal. The bulk of the foreign trade is carried on with the surrounding European countries, principally Germany.

PETROLEUM RESOURCES

There are two prospective oil regions in Czechoslovakia, one in the eastern and the other in the western part of the Carpathian Mountains. A small production is obtained at Gbely, north of Budapest; since its discovery in 1912, this field has been the most important source of petroleum in the Republic. The "bringing in" of a flowing well in this field has recently been reported. This is a Government reserve and is not included in the concession granted to American interests. The oil has a gravity of 20.5° Bé. (0.93 sp. gr.). Other oil indications extend along the flanks of the Carpathian Mountains, and constitute a continuation of the oil deposits of Poland and Roumania.

PETROLEUM LEGISLATION

A company which is reported to be a subsidiary of large American interests recently obtained from the Czechoslovakian Government a concession which amounts to a virtual monopoly of the petroleum industry in this country. The concession was granted on condition that a company be formed with a capital of 100,000,000 czechokronen, and that 30 per cent of the stock be given free to the Government, and 20 per cent sold to Prague interests; the company agrees to invest, within five years, 50,000,000 czechokronen additional in boring and prospecting. The concession has aroused protests against the Government's granting a monopoly of the petroleum industry to foreign interests.

AUSTRIA

INTRODUCTION

The Republic of Austria, the western part of the old Austro-Hungarian Empire, has an area of about 30,800 square miles and a population of approximately 6,130,000. The official language is German. Transportation facilities include about 4000 miles of railroad and the internationalized waterway of the Danube River. Access to the Black Sea is assured by the Danube, and rail transportation to the Adriatic Sea is guaranteed by treaty.

The Republic was established in November, 1918; and the President, who is elected for four years by the National Assembly, may be once re-elected. The budget deficit for 1922 is estimated at several billion dollars, and the National Debt at \$16,000,000,000.

Agriculture is the principal industry, with cereals as the chief product. The bulk of the foreign trade is with Great Britain, Czechoslovakia, and Germany.

PETROLEUM RESOURCES

There are petroleum indications in southern Austria, at Carinthia, where oil and gas are found in bituminous shales of the Upper Triassic, and in Tyrol, along the Italian border, where shales and asphalt are known at several localities northeast of Seefeld. In northern Austria, traces of petroleum are found in sands, shales, and coal-bearing beds of the Liassic, at Gresten, Grieskirchen, and Ebelsberg. Prospective drilling is going on near Vienna, north of the Danube, and near the village of Wollmannsberg 5 miles north of Stockeram.

PETROLEUM LEGISLATION

There is no special petroleum legislation. The old Austrian Mining Law seems to have depended upon a number of regulations applicable to different districts.

To start any research work, it is necessary for the prospector, even if he be the owner of the land, to obtain an exploration permit, which is issued for one year with a right of renewal. The right to exploitation concessions is created by proving that the areas covered by the exploration permit contain workable minerals.

The exploiter may execute, with the permission of the mining authority, any works outside his boundary for the more convenient extraction of his minerals. In all cases, the exploiter availing himself of this privilege is responsible for all damage caused to the other lands. The concessionaire must pay certain royalties to the Government, besides a rent of 8 florins for each unit of a mine measure.

HUNGARY

INTRODUCTION

Present-day Hungary is about one-third of the size of the kingdom which, with Austria, formed the Austro-Hungarian Empire of pre-war Europe. Its present area is about 35,700 square miles, and its population, chiefly Magyars, numbers about 7,840,000, with a density of 219 per square mile. The country is now cut off from the sea except by means of the internationalized waterway of the Danube. There are over 4000 miles of railroads.

Hungary is a monarchy, with executive and legislative power vested in a Regent and a Parliament, respectively. The budget deficit for 1922 is estimated at \$4,000,000, and the National Debt at \$14,000,000,000.

The industries of Hungary are based on agriculture, and include milling, distilling, sugar refining, and the manufacturing of hemp and flax.

PETROLEUM RESOURCES

There are petroleum indications in the southwestern part, in Zola County. At Szelnica and Peklemca, the Congeria beds yield thick oil with a gravity of 15.8 to 23.7° Bé. (0.96 to 0.91 sp. gr.). Oil indications are also found along the flanks of the Carpathian Mountains in the counties of Saros, Zemplin, Ungh, Beregh, and Marmaros.

PETROLEUM LEGISLATION

Exploration and exploitation rights are granted through concessions, under terms to be agreed upon between the Government and the concessionaire. However, Government officials have stated that no new concessions will be granted until the present agreement with a British concern expires, at the end of 1923.

JUGO-SLAVIA

INTRODUCTION

Jugo-Slavin is located in the southern part of Europe along the Adriatic Sea. It has an area of about 100,000 square miles, and a population of approximately 13,000,000 with a density of 130 per square mile. Serbian is the language in most common use. Transportation and communication facilities include 5500 miles of railway owned by the Government, 3500 miles of poor wagon roads, and 27,000 miles of telegraph and telephone line. The Danube, Save, and Drave are the navigable rivers.

The constitution provides for a limited monarchy with executive power vested in the King and Cabinet, and legislative power in the King and National Assembly. The budget deficit for 1922 is estimated at \$410,000,000 and the National Debt at \$705,000,000.

Agriculture is the main industry. The value of imports, principally metals, machinery, chemicals, and foodstuffs, is about three times as great as that of exports, chief of which are timber, maize, and corn.

PETROLEUM RESOURCES

Oil indications are found in two regions, in the Province of Croatia in northern Jugo-Slavia. One region extends southeast from Mur Island parallel with the river Drave, and the other southeast from Ivanic-Kloster parallel with the river Save. These prospective fields are probably the southwestern end of the belt which is bounded on the north by the oil fields of Poland and on the east by those of Roumania.

PETROLEUM LEGISLATION

The Mining Law of the 17th of May, 1922, provides that an exploration permit may be obtained from the Minister of Forests

and Mines, for a period of five years and for an area of 8 square kilometers, upon an advance payment of 400 dinars per year.

After prospecting is finished, an exploitation permit may be obtained, for a period of fifty years from the date of the exploration permit, and for an area of 50 hectares, upon an advance payment of 20 dinars per hectare per year. In addition, the Government receives a royalty of 55 per cent of the net profit.

Fifty per cent of the oil stock may be held by foreign capital; the State holds 25 per cent, and the remainder is reserved for home capital.

ALBANIA

INTRODUCTION

The Kingdom of Albania lies in the Balkan Peninsula along the Adriatic Sea, and is bounded on the north and east by Jugoslavia and on the south by Greece. It has an area of about 11,000 square miles and a population estimated at 1,700,000, with a density of 154 per square mile. The Chegs in the north and the Tosks in the south speak different dialects of the Albanian language, which is thought to be of Aryan origin. With the exception of the narrow coastal plain, the country is rugged and mountainous. There are no railroads in Albania and no wagon roads in the central part. The Italians have built several military highways in the south.

Albania was freed from Turkish rule in 1912, and a European prince, William of Weid, was appointed to rule the country. During the Great War, in 1917, a provisional government was established by the military authorities. No data concerning the financial and commercial status of the country are available.

The principal industries are agriculture and sheep-raising, with tobacco, wool, and olive oil as the chief products.

PETROLEUM RESOURCES

Extensive beds of asphalt are located at Selenitza and Rompzi, on the Voyutza; those at Selenitza are being exploited.

PETROLEUM LEGISLATION

Exploration and exploitation rights are granted through Government concessions, which must be approved by the Parliament after consideration by a committee. One granted to British

interests provides for the incorporation of a company with a nominal capital of £1,000,000, to be increased if necessary; 51 per cent of the stock is to be held by the company and 49 per cent by the Government and people of Albania, 20 per cent of which shall be given by the company to the Albanian Government without payment. The concession will run for fifty-five years, including three years to make the necessary investigations and and preparations for uncovering the oil in all Albania.

GREECE

INTRODUCTION

Modern Greece includes a mainland, connected by the Isthmus of Corinth with the Peloponnesian Peninsula, and a number of small islands. The area is estimated at 41,900 square miles, and the population at 4,800,000, with a density of 114 per square mile. By the Treaty of Versailles, the territory of Greece was greatly increased and extended around Constantinople to the Black Sea. Recent Turkish victories caused the loss of Thrace and Smyrna. Transportation and communication facilities include about 1500 miles of railroad, 50,000 miles of wagon roads, and 18,000 miles of telegraph and telephone lines. Greece has a longer coastline than any other European nation, and has many good harbors.

Greece was declared a kingdom in 1830, under the guarantee of Great Britain, France, and Russia. The legislative power is vested in a Parliament. For a number of years, the Government expenditures have exceeded the revenues; the National Debt was estimated at \$812,000,000, prior to the recent Turkish War.

Agriculture is the principal industry, with grains and currants as the chief products.

PETROLEUM RESOURCES

Oil indications are found in Miocene beds on the island of Zante, off the western coast of Peloponnesia, at Keri, Musaki, and Romirion; and on the mainland opposite Zante, at Linitz (Cyllene). In Macedonia near Koritza, in the northwest, and Salonika, petroleum indications have also been reported; and it is said that British interests have obtained a Government concession to drill for oil in this region.

PETROLEUM LEGISLATION

Greece has no special petroleum legislation; but the general mining law provides that when a concession for exploration is granted to a third party, the owner of the land has a right to indemnification fixed by the Administration. Rights of exploration may be forfeited if the work is suspended for more than six months without a just cause.

Rights of exploitation are granted through a royal decree. Property in the mines is immovable *ad perpetuum*, unlike surface property, and can be alienated like any other kind of property; but it cannot be divided or conveyed without the authorization of the Government. The owner of the surface has the first right to exploit mines located within his land. The State receives a tax of 6 per cent per hectare per year, and a royalty of 10 per cent of the net produce.

BULGARIA

INTRODUCTION

Bulgaria lies in the southern part of Europe and has access to the Black Sea. The Aegean coastline was ceded to Greece after the Great War. Bulgaria has an area of about 40,600 square miles, and a population of 4,340,000, with a density of 107 per square mile. Transportation and communication facilities include 6500 miles of wagon roads, 1500 miles of railroad, and 3500 miles of telegraph line. Railroads, telegraph, and telephone systems are owned and operated by the State.

The Government has been a constitutional monarchy since 1908, when independence of Turkey was declared. The budget deficit for 1922 is estimated at \$307,000,000, and the National Debt at \$1,500,000,000.

About two-thirds of the population is engaged in agriculture. The bulk of the exports, of which tobacco, grains, hides, and perfumes are most important, goes to Germany and the United States. The imports, chief of which are textiles and metals, come from Italy, Turkey, and Great Britain.

PETROLEUM RESOURCES

Deposits of oil shale are found in western Bulgaria, near the towns of Bresnik, Radomir, and Sirbinova; and in the central part, at Popovitz and Kazanlik. The shale ranges from 10 to 60 ft. in thickness; and, when subjected to a dry distillation, it yields crude oil, ammonia, and illuminating gas. The best results have been obtained from shales found near Sirbinova, analysis of which shows 21 per cent oil. Some authorities claim that the Bulgarian oil-shale deposits are among the most important on

record. They show a higher percentage of gasoline and lubricating oils than the Scottish oil shale.

PETROLEUM LEGISLATION

The Bulgarian Mining Law of 1910 is one of the most lenient, and was drawn after a thorough study of the various mining laws of other countries. Taxation is comparatively light, and includes a corporation tax based on profits, municipal property taxes, and minor stamp taxes.

Government concessions covering the exploration and exploitation of the western and central districts have been granted.

TURKEY

INTRODUCTION

The exact area of Turkey at the present date is still an unsettled matter, owing to the readjustment necessary after Turkey's victory over Greece in 1922. At all events, the Turkish dominion is extended into Europe by the annexation of Thrace and, with the territories north of Syria in Asia Minor, the total area is approximately 250,000 square miles and the population about 8,500,000. Transportation and communication facilities include 3500 miles of railroad and 29,000 miles of telegraph lines.

The Government is nominally a limited monarchy, with the Sultan and Parliament in Constantinople; but in April, 1920, under the auspices of Mustafa Kemal Pasha, a Grand National Assembly was convoked at Angora, Asia Minor, which has declared itself vested with legal and executive power, without, however, throwing off its allegiance to the Sultan. In the treaty of Sèvres (August, 1920), it is provided that Turkish finances shall be controlled by a Finance Commission composed of representatives from Great Britain, France, and Italy. The National Debt is estimated at \$2,310,000,000.

The bulk of the foreign trade, both export and import, is carried on with Great Britain, the United States, France, Italy, and Russia.

PETROLEUM RESOURCES

Asphalt and traces of oil are reported at Cherkose Deli and Mount Ida, south of the Sea of Marmora; at Janartasch, on the Gulf of Adalia, there are emanations of natural gas.

After the defeat of the Greek army in 1922, the Turkish

Government again claimed ownership of the oil region near Mosul in northern Mesopotamia, which was taken over by Great Britain after the Great War.

PETROLEUM LEGISLATION

The mining law of Turkey provides that the owner of the surface is also the owner of the subsoil. Exploration rights are granted by a Government permit, upon payment of a tax of 3 to 5 Turkish pounds; the petitioner pays another tax of 5 to 15 Turkish pounds, according to the extent of the land granted by the permit. Permits are for one year, without a right of renewal, and work must be begun within six months from the date of issue.

Exploitation rights are granted through concessions issued by virtue of an Imperial Irade, and if the concession is not granted to the discoverer, the concessionaire must indemnify the discoverer for his discovery. Drilling must be begun within two years of the granting of the concession. In public lands, a royalty of 20 per cent of the products goes to the State. On private lands, work cannot be started without the consent of the owner. The concessionaire may use the lands that he needs for exploitation, upon payment of indemnity to the owner of the surface.

ABYSSINIA

INTRODUCTION

The Kingdom of Abyssinia, in eastern Africa, covers a territory of about 400,000 square miles and has a population of approximately 8,000,000. It is located near the southern entrance to the Red Sea; but, owing to several small foreign possessions along the coast, the country has no access to seaboard. The southern part may be reached by way of the Blue Nile or through Italian and British Somaliland. The capital, Adis Ababa, is connected by rail with Djibouti, in French Somaliland on the Gulf of Aden. There are no wagon roads, and transport is effected by means of mules, pack horses, and camels.

The King is an absolute monarch, and rules the country in true medieval fashion.

Exports consist mainly of hides, coffee, and ivory. Imports include cotton goods, hardware, sugar, and kerosene; they come from Great Britain, France, and India.

PETROLEUM RESOURCES

Oil indications are reported at Aukohar in central Abyssinia, and near Horar about 200 miles from the coast; but no development work has been undertaken.

PETROLEUM LEGISLATION

There is no mining legislation, and the granting of permits for exploration and exploitation depends entirely on the good will and judgment of the present Abyssinian ruler.

AFGHANISTAN

INTRODUCTION

Afghanistan is situated in the southwestern part of Asia, and is separated from the Arabian Sea by Persia and Baluchistan. It has an area of about 240,000 square miles and a population of approximately 6,000,000. The languages spoken are Persian and Pushtoo. There are no railroads and very few wheeled vehicles in the country. Merchandise is still carried by camels or mules, to and from Persia, Baluchistan, and India. The only access to the sea is through these countries.

The Government is monarchical, under one hereditary Prince, whose power varies. The country is divided into four provinces, each under a Governor. Relations with Great Britain were settled by a treaty in November, 1921, in which Great Britain recognized the complete independence of Afghanistan.

Sheep-raising and agriculture are the principal industries. Sheep-skins and preserved fruits are the chief exports.

PETROLEUM RESOURCES

Petroleum deposits have been reported near Kabul, the capital; and at Herat, near the Persian frontier. No development has been attempted.

PETROLEUM LEGISLATION

Oil rights are controlled by the Government, which will grant concessions for the exploration and exploitation of oil upon terms to be agreed upon by the Government and the negotiating interests. There are no restrictions against foreigners.

CHINESE REPUBLIC

INTRODUCTION

The Republic of China, with an area of approximately 400,000,000 square miles, includes a larger territory than Europe or the United States. It is separated from other Asiatic countries by deserts and mountain chains. The topography of the country is generally hilly, although a large region is made up of the fertile plains along the lower courses of the Hwang-ho and the Yang-tse-kiang. The population is estimated at 400,000,000, or nearly four times that of the United States. Transportation facilities for the entire country include only about 7000 miles of railroad, which means that the vast internal trade is carried on over the narrow roads, numerous canals, and navigable rivers.

With the overthrow of the old Manchu dynasty in 1912, China became a republic which, after a rather unsettled period, is now being consolidated. Executive authority is vested in the President, Premier, and Cabinet. Some outlying provinces, under the rule of their native military governors, are endeavoring to become independent of the central Government. China's National Debt is estimated at \$1,886,000,000, which may be considered small in the light of the country's resources and population. It is interesting to note that China has never repudiated any of its foreign obligations, and foreign interests have always been indemnified for losses due to rebellions, riots, or other disturbances.

Agriculture, conducted in a primitive fashion, occupies 85 per cent of the people. The principal products are rice, cotton, sweet potatoes, cereals, and the mulberry tree. The foreign trade has increased five-fold in thirty years. The principal exports, in order

of their importance, are silk, beans, cotton, and tea; the imports are cotton goods, metal products, tobacco, and cigarettes.

PETROLEUM RESOURCES

Petroleum indications are found in the Huisan Mountains in northern Manchuria; in the east central part, in the province of Shansi, at the Yenchang field, and Shensi, southwest of Ningtiao-liang; in the central part, south of the Gobi Desert, in the Nanchung Mountains along the Tsche-king-sia River; in the southwestern part, in Tibet at Checkong, Ponkki, Szuchan, and Fu-chuan; and in the southeastern part, in the Province of Kouang-si at Loo-choo-koo and Tai-li-cheu.

Borings in the southern fields produce an oil with a gravity of 29° to 33° Bé. (0.88 to 0.86 sp. gr.).

The sinking of brine wells in Shensi is an art of great antiquity, and the forerunner of modern oil-well drilling. The wells are usually 1500 to 1800 ft. deep and 5 or 6 in. in diameter. Gas and oil accompany the brine from the well.

In 1914, an investigation and development of the petroleum resources in the provinces of Shensi and Chihli was attempted. Active drilling operations were commenced during the year, in the Yenchang field, Shensi, in a locality where a number of wells drilled six or seven years before had resulted in two small producers, supplying oil to a small refinery with a purely local trade. No oil was discovered except in the immediate neighborhood of the original Yenchang wells. The enterprise was finally abandoned, but it has been reported that the Japanese are to undertake the exploration of Shensi Province.

PETROLEUM LEGISLATION

The oil resources of China are controlled by the Government. Concessions for exploration and exploitation are granted by the Secretary of Agriculture, through agreements between the Gov-

ernment and the negotiating interests. All exploitation is supervised by the Government. There is no discrimination against foreigners.

Following this policy, the Government has given to a British company a concession for the development of the oil resources in Turkestan.

TABLES

WORLD'S PRODUCTION OF CRUDE PETROLEUM SINCE 1857,

Year	Rumania	United States	Italy	Canada	Russia	Poland	Japan	Germany	India
1857	1,977								
1858	3,560								
1859	4,349	2,000							
1860	5,543	500,000	36						
1861	17,279	2,113,609	29						
1862	23,198	3,056,690	29	11,775					
1863	27,943	2,611,309	58	82,814	40,816				
1864	33,013	2,116,109	72	90,000	64,686				
1865	39,017	2,497,700	2,265	110,000	66,542				
1866	42,534	3,597,700	992	175,000	83,052				
1867	50,838	3,347,300	791	190,000	119,917				
1868	55,369	3,646,117	367	200,000	88,327				
1869	58,533	4,215,000	144	220,000	202,308				
1870	83,765	5,260,745	86	250,000	204,618				
1871	90,030	5,205,234	273	269,397	165,129				
1872	91,261	6,293,194	331	308,100	184,391				
1873	104,036	6,893,766	467	365,052	474,379				
1874	103,177	10,926,945	604	168,807	583,751	149,837			
1875	108,569	8,787,514	813	220,000	697,364	158,522	4,566		
1876	111,314	9,132,669	2,891	312,000	1,320,528	164,157	7,708		
1877	108,569	13,350,363	2,934	312,000	1,800,720	169,792	9,580		
1878	109,300	15,396,868	4,329	312,000	2,400,960	175,420	17,884		
1879	110,007	19,914,146	2,891	575,000	2,761,104	214,800	23,457		
1880	114,321	26,286,123	2,035	350,000	3,001,200	229,120	25,497	9,310	
1881	121,511	27,661,238	1,237	275,000	3,601,441	286,400	16,751	29,219	
1882	136,610	30,349,897	1,316	275,000	4,537,815	330,078	15,549	58,025	
1883	139,486	23,449,633	1,618	250,000	6,002,401	365,160	20,473	26,708	
1884	210,667	24,218,438	2,855	250,000	10,804,577	408,120	27,923	46,161	
1885	193,411	21,858,785	1,941	250,000	13,924,596	465,400	29,237	41,360	
1886	188,666	28,064,841	1,575	584,061	18,006,407	305,884	37,916	73,864	
1887	181,907	29,253,483	1,451	525,655	18,307,781	343,832	28,445	74,284	
1888	181,576	27,612,025	1,651	685,203	23,048,787	468,537	37,436	84,782	
1889	297,666	35,163,513	1,273	704,690	24,609,407	515,268	62,811	68,217	94,250
1890	383,227	45,823,572	2,998	795,000	28,691,218	659,012	61,420	108,296	118,065
1891	488,201	54,292,655	8,305	755,298	34,573,181	630,730	52,917	108,929	190,131
1892	593,175	50,814,667	18,321	779,763	35,774,504	646,220	68,901	101,404	242,284
1893	525,655	48,431,066	19,069	798,406	40,456,519	692,669	106,384	99,390	298,969
1894	507,255	49,344,517	20,552	829,104	36,375,428	949,146	171,744	122,564	327,218
1895	575,200	52,892,376	25,843	726,138	46,140,174	1,452,999	141,310	121,277	371,636
1896	543,348	60,960,361	18,149	726,822	47,220,633	2,443,080	197,082	145,061	429,979
1897	570,896	60,475,516	13,892	709,867	54,399,588	2,226,368	218,559	165,745	545,704
1898	776,238	55,364,233	14,459	768,391	61,609,357	2,376,108	266,389	183,427	542,110
1899	1,426,777	57,070,860	16,121	808,570	66,964,963	3,336,079	192,232	140,971	940,971
1900	1,628,535	63,630,529	12,102	913,498	75,779,417	2,346,505	266,814	358,297	1,078,264
1901	1,678,320	69,389,194	16,150	756,679	85,168,556	3,251,544	1,110,790	313,630	1,430,716
1902	2,059,935	88,786,916	18,933	530,624	80,540,044	4,142,159	1,193,038	353,674	1,617,363
1903	2,793,117	100,461,337	17,876	498,637	75,591,256	5,234,475	1,209,371	445,818	2,610,259
1904	3,599,026	117,080,960	25,476	552,575	78,536,655	5,947,393	1,419,473	637,837	3,388,468
1905	4,420,967	134,717,580	44,027	634,095	84,980,270	8,765,317	1,472,804	660,963	4,187,098
1906	6,378,184	126,493,936	53,577	569,753	58,897,311	5,467,967	1,710,768	578,610	4,015,803
1907	8,118,207	166,095,335	59,575	788,872	61,850,734	8,455,841	2,001,838	766,631	4,344,162
1908	8,832,187	178,527,355	50,966	527,987	62,198,447	12,612,295	2,070,145	1,009,278	5,047,038
1909	9,327,278	183,170,874	42,388	420,755	65,970,350	14,932,799	1,889,653	1,018,837	6,076,617
1910	9,722,806	209,557,438	50,890	316,895	70,336,574	12,673,688	1,980,661	1,032,622	6,137,950
1911	11,107,450	220,449,391	74,709	291,096	66,183,991	10,519,270	1,658,903	1,017,465	6,451,203
1912	12,976,232	222,935,044	53,778	243,336	68,019,208	8,535,174	1,671,405	1,031,050	7,116,672
1913	13,564,768	248,446,230	47,198	228,080	62,834,356	7,818,130	1,942,009	985,764	7,930,149
1914	12,826,579	265,762,535	39,849	214,805	67,020,522	5,033,350	2,738,378	995,764	7,409,792
1915	12,029,913	281,104,104	43,898	215,464	68,548,062	4,158,899	3,118,464	995,764	8,202,674
1916	8,945,029	300,767,158	50,555	198,123	72,801,110	6,461,706	2,997,178	995,764	8,871,137
1917	3,720,760	335,315,601	40,763	213,832	69,960,000	5,965,447	2,882,378	995,764	8,078,543
1918	8,730,233	358,927,716	35,953	304,741	40,456,182	5,591,620	2,449,069	711,260	8,000,000
1919	6,517,748	378,367,000	38,254	238,171	34,284,000	5,255,800	2,120,500	925,420	8,583,800
1920	7,435,344	442,929,000	34,190	198,425	25,429,600	5,806,116	2,139,177	212,046	7,800,000
1921	8,368,000	472,185,000	34,400	190,000	29,150,000	5,167,000	2,000,000	200,000	6,954,000
1922	8,500,000	551,197,000	35,000	200,000	30,000,000	4,000,000	2,600,000	200,000	6,800,000

**AREA, POPULATION, NATIONAL DEBT, AND RAILROAD MILEAGE OF
PRODUCING AND PROSPECTIVE OIL COUNTRIES**

Countries	Area in square miles	Popula- tion	Density per square mile	National debt in millions of dollars	National debt per capita in dollars	Railroad mileage	Railroad mileage per 10,000 square miles
<i>Producing Fields.</i>							
United States. .	3,026,000	105,700,000	34.9	22,691	214.67	264,000	872
Mexico.....	767,000	15,800,000	20.6	282	17.85	16,000	208
Russia.....	8,166,000	131,000,000	16	22,774	173.85	46,000	56
Dutch East India	683,000	49,200,000	72	149	3.03	4,000	59
Persia.....	628,000	10,000,000	15.9	50	5	350	
Roumania.....	122,000	17,400,000	142.6	5,270	302.87	7,000	574
India.....	1,802,000	319,000,000	177	2,263	7.09	40,000	222
Poland.....	149,000	26,000,000	174.5	69,000	2,653.85	11,600	779
Peru.....	722,000	5,800,000	8	29	5	2,000	28
Japan.....	260,000	77,000,000	296.2	1,713	22.25	8,000	308
Trinidad Island	1,862	360,000	193.3	1	2.77	124	620
Venezuela.....	398,000	2,500,000	6.3	41	16.40	600	15
Argentina.....	1,150,000	8,700,000	7.5	760	87.36	22,500	196
British Borneo	77,000	930,000	12.1	.25	.26	127	16
Egypt.....	350,000	12,750,000	36.4	461	36.16	2,000	57
Colombia.....	460,000	6,000,000	13	.42	7	800	17
<i>Miscellaneous Pro- ducing Fields:</i>							
France.....	212,000	39,500,000	186	51,000	1,291.14	25,000	1,179
Canada.....	3,700,000	8,800,000	2.4	2,345	266.48	39,000	105
Germany...	185,000	59,800,000	323.2	71,000	1,187.29	36,000	1,946
Italy.....	180,000	40,000,000	222.2	18,650	466.25	9,700	539
Scotland.....	30,000	4,900,000	163.3	(see England)	.....	4,000	1,333
<i>Prospective Fields:</i>							
Alaska.....	590,000	55,000	.1	no debt	.....	800	14
Philippine Islands	115,000	10,000,000	86.9	21	2.10	800	70
England.....	50,000	35,000,000	700	38,000	1,065.02	16,000	3,200
Barbados.....	166	200,000	1,204.8	2	10	28	1,680
Grenada.....	133	65,000	488.7	1	15.39		
Mesopotamia .	140,000	2,800,000	20	no debt	.....	950	68
Palestine.....	9,000	770,000	85.5	no debt	.....	625	694
Australia.....	3,000,000	5,000,000	1.8	1,956	391.20	23,000	77
New Zealand...	103,000	1,200,000	16.7	928	773.33	3,000	291
Papua.....	90,000	251,000	2.8	no debt			
Gold Coast.....	80,000	2,100,000	26.3	16	7.62	277	34
Nigeria.....	332,000	16,300,000	49.1	57	3.50	1,100	33
British Somaliland	68,000	300,000	4.4	no debt			
Rhodesia.....	440,000	1,800,000	40.9	no debt	.....	2,500	56
Union of South Africa.....	474,000	7,140,000	15	847	118.63	10,000	211

**AREA, POPULATION, NATIONAL DEBT, AND RAILROAD MILEAGE OF
PRODUCING AND PROSPECTIVE OIL COUNTRIES—Continued**

Countries	Area in square miles	Popu- lation	Density per square mile	National debt in millions of dollars	National debt per capita in dollars	Railroad mileage	Railroad muleage per 10,000 square miles
<i>Prospective Fields— Continued</i>							
Morocco	231,000	6,000,000	25 9	103	171 7	700	30
Algeria	222,000	5,800,000	26 4	35	6 03	2,200	99
Tunis	47,000	2,100,000	44 6	69	32.86	2,500	532
French Equatorial Africa	1,000,000	9,000,000	9	no debt	.....	500	5
Madagascar ..	230,000	3,500,000	15 2	20	5.71	776	34
New Caledonia..	7,500	50,000	6 6	no debt	.....	90	120
Syria	60,000	3,000,000	50	no debt	.....	1,000	167
French Guiana..	32,000	50,000	1.6	no debt	.....	30	9
Portugal	36,000	6,000,000	166.6	1,880	313.33	2,000	555
Portuguese West Africa	450,000	4,000,000	8.8	no debt	.....	800	18
Portuguese East Africa	400,000	3,000,000	7.5	no debt	.....	600	15
Belgian Congo..	900,000	11,000,000	12 2	67	6 09	2,500	28
Dutch Guiana..	46,000	113,000	2.5	no debt	.....	90	18
Guatemala.....	48,000	2,000,000	41 6	18	9	450	94
Honduras	46,200	650,000	14	30	46 15	460	100
Salvador	7,000	1,500,000	214.3	18	12	213	304
Costa Rica	23,000	470,000	20.4	30	63 83	400	174
Panama	31,900	401,000	12.5	3	7.48	180	56
Cuba	44,000	2,900,000	65.9	87	30	3,200	727
Dominican Re- public	19,000	895,000	47	13	14 53	400	210
Ecuador	116,000	1,500,000	12 9	28	18 67	400	34
Bolivia	515,000	2,890,000	5.6	27	9 34	1,400	27
Brasil	3,275,000	30,600,000	9.3	969	31 67	18,000	55
Chile	290,000	3,755,000	12 9	258	68.70	5,000	190
Spain	190,000	20,000,000	105 2	2,335	116 75	9,000	474
Czechoslovakia..	54,300	13,600,000	251 9	9,135	671 69	8,500	1,565
Austria	30,800	6,130,000	199 3	16,000	2,610 11	4,000	1,300
Hungary	35,700	7,840,000	219 3	14,000	1,785 71	4,000	1,400
Jugo-Slavia	100,000	13,000,000	130	705	54.23	5,500	550
Albania	11,000	1,700,000	154 5	no debt	.....	.....	.....
Greece	41,900	4,800,000	114 5	812	169 16	1,500	36
Bulgaria	40,600	4,340,000	106 9	1,500	345 62	1,500	37
Turkey	250,000	8,500,000	34	2,310	271 76	3,500	140
Abyssinia	400,000	8,000,000	20	no debt	.....	.....	.....
Afghanistan	240,000	6,000,000	25	no debt	.....	.....	.....
Chinese Republic	4,000,000	400,000,000	100	1,886	4 72	7,000	17

FOREIGN COINS VALUED IN UNITED STATES MONEY
(at normal rate of exchange)

Country	Monetary unit	Value in terms of U. S. money
Argentina.....	Peso	\$0 9648
Austria.....	Krone.....	.2026
Belgium.....	Franc. ....	.1930
Bolivia.....	Boliviano..	.3893
Brazil.....	Milreis. ....	.5462
British Colonies in Australia and Africa.	Pound sterling	4 8665
British Honduras.....	Dollar.....	1 0000
Canada	Dollar.....	1 0000
Chile.....	Peso.....	.3650
China.....	Tael.....	{ 1 03*
	Dollar.....	{ 1 14*
		.74*
Costa Rica.....	Colon.....	.4653
Cuba.....	Peso.....	1.0000
Denmark.....	Krone. ....	.2680
Dominican Republic	Dollar	1.0000
Ecuador.....	Sucre.....	.4867
Egypt.....	Pound (100 piast's)	4.9431
Finland	Markka.....	.1930
France.....	Franc.....	.1930
Germany.....	Mark.....	.2382
Great Britain.....	Pound sterling.....	4 8665
Greece.....	Drachma.....	.1930
Guatemala	Peso.....	.6864
Haiti.....	Gourde.....	.2500
Honduras.....	Peso.....	.6864
Hungary.....	Krone.....	.2026
India (British).....	Rupee .....	.3244
Indo-China.....	Piaster.....	.7413
Italy.....	Lira.....	.1930
Japan.....	Yen.....	.4985
Liberia.....	Dollar.....	1.0000
Mexico.....	Peso.....	.4985

* The value of the Tael and dollar varies slightly, due to a difference in the premium charged on these currencies in the various cities.

FOREIGN COINS VALUED IN UNITED STATES MONEY—*Continued*
(at normal rate of exchange)

Country	Monetary unit	Value in terms of U. S. money
Netherlands	Guilder (Florin)	\$.4020
Newfoundland	Dollar	1 0000
Norway	Krone . . . . .	.2680
Panama	Balboa	1 0000
Paraguay	Peso (Argentine)	.9648
Persia	{ Achrefi . . . . .	.0959
	{ Kran . . . . .	.1264
Peru	Libra	4.8665
Philippines	Peso . . . . .	.5000
Portugal	Escudo	1 0805
Roumania	Leu . . . . .	.1930
Russia	Ruble . . . . .	.5146
Salvador	Colon . . . . .	.5000
Serbia	Dinar . . . . .	.1930
Siam	Tical . . . . .	.3709
Spain	Peseta . . . . .	.1930
Straits Settlements	Dollar . . . . .	.5678
Sweden	Krona . . . . .	.2680
Switzerland	Franc . . . . .	.1930
Turkey	Piaster . . . . .	.0440
Uruguay	Peso	1.0342
Venezuela	Bolivar . . . . .	.1930

Gold is the legal standard for all countries, with the exception of Guatemala, Honduras, China and Indo-China, where the standard is silver, and Belgium, France, Greece, Italy, Persia and Spain, where the silver-gold standard is used.

PHYSICAL AND REFINING PROPERTIES OF PETROLEUM

Producing countries	Baumé degree	Specific gravity	Gasoline %	Kerosene %	Gas oil %	Lubricating oils %	Fuel oil %	Asphalt %	Paraffin %	Tar %	Coke %	Residuum %
<i>United States:</i>												
Appalachian.....	39°-45°	0.828-0.80	35	27	10	15						
Lima-Indiana.....	28°-43°	0.886-0.81	35	15	12	12	25					
Illinois.....	32°-3°	0.863	20	15	8	16						
Mid-Continent.....	34°	0.854	22	15	12	29		12 5				
Gulf Coast.....	21°-7°	0.923			7	75						
Rocky Mountain.....	36°-5°	0.841	29	15	10	17						
California.....	14°-40°	0.972-0.823	22	19		18						21
<i>Mexico:</i>												
Panama.....	12°-2°	0.984	2	4	14	12	74	66	1			
Des Bocas-Alamo.....	20°-1°	0.833	8	9	3	20						15
Tehuantepec.....	32°-5°	0.86	20	25								
<i>Russia:</i>												
Baku.....	30°-49.5°	0.873-0.78	6-49	33-44		57-0			5			
Grozny.....	30°	0.875	19	16		56						
Emba.....	16.6°-34.7°	0.955-0.85	2	11		86						
Maikop.....	32°-8°	0.86	13	33		53						
<i>Dutch East Indies:</i>												
Borneo.....	33°	0.859	17	44		33			6			
Sumatra.....	38°-48°	0.833-0.789	20-26	47-63		7-31			7			
Java.....	32°-4°	0.862		51		42	2					12
Persia.....	38°-7°	0.83	5	52		40						
Roumanian.....	51°	0.773	50	38								
<i>India:</i>												
Burma.....	43°-8°	0.81	9	63		26						
Assam.....	26°-6°	0.84	9	38		49	3					
Punjab.....	25°	0.807							9			
Poland.....	34°-3°	0.852	12	37		31	4	...				
Peru.....	33°-7°	0.855	11	42		41						
Japan.....	37°-9°	0.834	26	48		6						
Trinidad Island.....	25°-2°	0.902	13	40		39	7					
Venezuela.....	18°	0.946	6	9		85						
Argentina.....	23°	0.915	3	10								
Egypt.....	22°	0.921	8	14		24	22	10	8			87
Colombia.....	36°	0.843	60	6		20	6	12				
France.....	29°	0.88	4	20		19						
Germany.....	33°-1°	0.858	5	42		8			25	10		
Canada.....	17°-4°	0.95		25		18			2			
Italy.....	39°-47°	0.828-0.79	30	52		47						

**LIST OF CALIFORNIA AND ROCKY MOUNTAIN OIL FIELDS
SHOWN ON MAP OF UNITED STATES AND MEXICO (page 1)**

CALIFORNIA

Arroyo Grande	9	Midway Sunset... ..	6
Belridge	4	Montebello... ..	14
Coalinga... ..	2	Newhall	12
Coyote Hills	14	Redondo... ..	17
Elk Hills	7	Richfield.....	14
Huntington Beach ..	16	Pico... ..	12
Kern River	8	Santa Fe Springs ..	14
Lompoc	10	S. nta Maria	10
Long Beach	15	Summerland. . . .	11
Los Angeles-Salt Lake.	13	Watsonville	1
Lost Hills... ..	3	Whittier-Fullerton.....	14
McKittrick	5		

ROCKY MOUNTAIN

Boulder... ..	32	Lance Creek	25
Byron	6	Lost Soldier....	17
Bolton Creek	21	Maverick Springs ..	12
Big Muddy	23	Moorcraft... ..	30
Cat Creek	2	Mule Creek... ..	26
Dallas.....	15	Osage	27
Devils Basin	3	Pilot Butte... ..	13
Douglas	22	Poison Spider	20
Dry Piney	16	Rangley	31
Elks Basin	5	Rock Creek	19
Ferris	18	Salt Creek	24
Florence	33	Soap Creek	4
Grass Creek... ..	9	Teapot	24
Greybill	7	Torchlight....	8
Hamilton Dome	10	Upton-Thornton. . . .	28
Kevin-Sunburst	1	Wakeman... ..	29
Lander.....	14	Warm Springs.....	11

LIST OF OIL FIELDS SHOWN ON MAP OF MID-CONTINENT AND
GULF COAST DISTRICTS (page 115)

MID-CONTINENT

KANSAS

Altoona.....	E 12	Leon.....	D 9
Arkansas City.....	G 18	Longton.....	F 11
Augusta.....	E 8	Moran.....	D 13
Beaumont.....	E 10	Mound Valley ..	F 12
Benedict.....	E 12	Neodesha ..	F 12
Buffalo.....	E 12	Neosha Falls ..	D 12
Cambridge.....	E 10	New Albany.....	E 11
Caney-Tyro.....	G 12	New Salem.....	F 9
Chantauqua ..	G 11	Niotaze ..	G 11
Chanute-Humbolt. .	E 12	Ottawa ..	B 13
Coffeyville ..	G 12	Paola.....	B 14
Colfax ..	F 11	Peabody.	C 8
Dexter.....	G 9	Peru.....	G 11
Douglas.....	E 8	Pixlee.....	C 9
Elbing ..	C 8	Potwin.....	D 12
El Dorado.....	D 9	Sallyards.....	D 10
Elgin.....	G 10	Sedan ..	G 11
Elk City.....	F 11	Seely ..	C 11
Erie.....	E 13	Sluss-Smock ..	D 9
Eureka.....	D 10	Teeter ..	C 10
Florence ..	C 9	Thayer.....	E 12
Fox Bush ..	E 9	Utopia.....	D 11
Freedonia ..	E 12	Vernon.....	D 12
Hale.....	F 11	Virgil.....	C 11
Hepler.....	E 14	Wellsville ..	B 13
Iola.....	D 12	Winfield ..	G 9
Independence...	F 12	Yates Center ..	D 12

OKLAHOMA

Ada.....	O 10	Bald Hill.....	K 12
Adair.....	H 12	Bartlesville-Dewey.....	H 11
Allen.....	O 10	Beggs.....	L 11
Alluwe-Chelsea ..	I 12	Billings.....	I 8
Avant.....	I 11	Bigheart.....	I 11
Barbara.....	L 11	Bixby.....	K 12
Barnes.....	I 7	Blackwell.....	H 8

Booch.....	L 12	Fort Ring.....	P 6
Boston.....	J 10	Garber.....	J 7
Boynton.....	L 12	Gladys Belle.....	P 6
Bristow.....	L 10	Glenn Pool.....	K 11
Brockins.....	L 11	Gotebo.....	N 4
Broken Arrow.....	K 12	Graham.....	P 8
Brown.....	K 12	Granite.....	N 2
Buck Creek.....	H 11	Hallett.....	J 10
Bull Creek.....	I 11	Haskell.....	K 12
Burbank.....	H 9	Healdton.....	Q 8
California Creek.....	H 12	Henryetta-Schulter.....	M 12
Caney.....	H 11	Hewitt.....	Q 8
Casey.....	J 9	Hobart.....	N 4
Catoosa.....	J 12	Hogshooter.....	I 12
Cement.....	N 6	Holdenville.....	N 10
Chickasha.....	N 7	Hominy.....	I 10
Claremore.....	J 12	Hominy Townsite.....	I 10
Cleveland.....	J 10	Hominy Sec. 8.....	I 10
Coal County.....	O 12	Ingalls.....	J 9
Cole.....	L 12	Inola.....	J 12
Collinsville.....	I 12	Isom Springs.....	R 10
Comanche.....	P 6	Jenks.....	K 11
Coody Bluffs.....	I 12	Jennings.....	J 10
Copan.....	H 11	Kellyville.....	K 11
Council Hill.....	L 12	Keystone.....	J 10
Coweta.....	K 12	Kilgore-Lindsay.....	O 7
Cushing Oilton.....	K 9	Kimble.....	L 11
Delaware-Childers.....	H 12	Lark.....	R 10
Delaware Creek.....	J 11	Lawton.....	P 6
Deaner.....	M 11	Leonard.....	K 12
Deep Fork.....	L 12	Little Hominy.....	I 10
Deer Creek.....	H 7	Loco.....	Q 7
Drumright-Shamrock.....	K 9	Luck.....	L 12
Duncan.....	P 6	Lyons-Quinn.....	M 11
Dustin.....	M 11	Major.....	K 12
East Morris.....	L 12	March.....	K 9
Eram.....	L 12	Maramec.....	J 9
Eufalia.....	M 13	Maud.....	H 10
Fern Mountain.....	K 13	McAlister.....	N 12
Flat Rock-Bird Creek.....	J 11	Meyers.....	H 10
Fox Pool.....	P 8	Morris.....	L 12
Francis.....	O 10	Morrison Otoe.....	J 9
French.....	M 11	Morse.....	L 10

Mounds.....	K 11	South Elgin.....	H 10
Mudill.....	Q 10	Spiro.....	M 14
Muskogee	L 13	Squirrel.....	H 11
Natura... ..	L 12	Stebbins	L 11
Newkirk-Mervine.....	H 8	Stedham	M 13
Newman	L 11	Stigler	M 14
Nowata-Claggett	H 12	Stone Bluff.....	K 12
Ochelata Ramona	I 11	Stroud.....	L 9
Okemah.....	M 10	Surber ..	P 6
Okesa.	H 11	Talala	I 12
Okmulgee	L 12	Thousand Acre Lake	L 12
Osage City	J 10	Tiger Flats	L 11
Owasso	J 12	Tonkawa..	I 8
Paden	L 9	Turkey Creek.	J 11
Pawhuska.....	L 10	Turley....	J 11
Pearson.....	H 10	Twin State	M 11
Pershing	L 10	Two Four	P 8
Phillipsville.	L 11	Vera... .	I 12
Pine Pool	L 12	Velma	P 7
Ponca City.....	H 8	Vian... .	M 13
Pond Creek	H 10	Wagoner	K 13
Preston Hamilton Switch... L 12		Walters	P 6
Porter	K 13	Wainwright	L 12
Poteau..	N 14	Wann... .	H 12
Quinton..	N 13	Weiner... .	H 13
Red Fork	K 11	Weleetka..	M 11
Red Oak.....	N 13	West Bigheart	I 11
Ramsey.....	H 11	Wetumka	M 10
Ripley..	K 9	Wewoka....	N 10
Robberson.....	O 7	Wheeler.....	Q 8
Salt Creek.....	L 11	Wilcox... .	L 11
Sand Springs	J 11	Wildhorse Creek	J 10
Section 36.....	J 10	Wynona....	I 10
Shepard..	L 12	Yahola.....	K 12
Skaitook	J 11	Yale.....	J 9
Slick.....	K 11		

LOUISIANA

Anse-la-Bute.....	18	Cedar Grove.....	9
Bellevue.	7	Elm Grove.....	8
Bethany..	10	Evangeline.....	14
Bull Bayou	12	Gleason.....	6
Caddo.....	11	Haynesville	4

Homer	5	Oil Springs.....	20
Jennings.....	16	Pelican	13
Monroe.....	3	Vinton.....	15
Morehouse.....	3	Welsh	16
New Iberia	19		

ARKANSAS

El Dorado.....	2	Smachover.....	1
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TEXAS

Alta Vista.....	32	Hoskins Mound	58
Amarilla.....	7	High Island	48
Bangs	26	Hillburn	24
Batson	50	Humble	53
Big Hill	47	Hull	49
Big Mound	57	Ibex	13
Black Ranch	8	Iowa Park	4
Blue Ridge	56	Ivan	10
Brazos	21	Jacksboro.....	6
Breckenridge	12	Kosse	37
Brownwood	27	K. M. A.....	4
Bryan Dome.....	59	Lockhart	33
Bunger.....	8	Lohn.....	30
Burkburnett.....	2	Luling.....	33
Burkett.....	25	Matagorda.....	60
Caddo.....	11	Markham.....	61
Carthage	41	Mexia	38
Corpus Christi.....	62	Mineral Wells.	20
Corsicana.....	40	Mirando.....	68
Crowther	64	Mirando City	66
Curri-Wortham.....	39	Mission.....	32
Curry	14	Moran.....	15
Damon Mound	57	Morris	25
Dalton.....	19	Nocogdoches	42
Dayton.....	51	Orange	45
Del Rio.....	31	Petrolia.....	1
Desdemona.....	22	Pierce Junction.....	55
Electra.....	3	Piedras Pintas.....	63
Goose Creek.....	52	Pioneer.....	24
Halliday.....	5	Powell.....	40
Hockley.....	54	Putnam.....	16

Ranger	17	Sour Lake	44
Reiser	65	Spindle Top	46
Rockdale Minerva	35	Starr	69
Santa Anna	29	Stratton Dome	59
Saratoga	43	Strawn	18
Schott	67	Thrall	34
Sipe Springs	23	Tracy	35
Somerset	32	Trickham	28
South Bend	9	West Columbia	57
South Bosque	36		

LIST OF OIL FIELDS AND OIL INDICATIONS SHOWN ON MAP
OF PERSIA (page 56)

MESOPOTAMIA

1. Hit
2. El Deir
3. Gayara
4. Nineveli
5. Kerkuk
6. Kifri
7. Mandali

5. Qasr-i-Shirin
6. Quihm Island
7. Daliki
8. Lake Urumieh Region
9. Anzeli
10. Shaktesar
11. Gumush Tepe
12. Schahkuh-i-balae
13. Semnan

PERSIA

1. Maidan-i-Napthun
2. Kirmanshah
3. Musjid-i-Suleiman
4. White Oil Springs

AFGHANISTAN

1. Kabul
2. Herat

LIST OF OIL FIELDS AND OIL INDICATIONS SHOWN ON MAP
OF ASIA (page 217)

TURKEY

1. Cherkose Deli
2. Mt. Ida
3. Janartasch
4. Erzerum, Armenia

5. Benaïd-el-Oar
6. Bahrein

MESOPOTAMIA

PALESTINE, SYRIA AND ARABIA

1. Yarmuk Valley, Palestine
2. Dead Sea Region, Palestine
3. Upper Jordan, Syria
4. Dead Sea Region, Syria

1. Hit
2. El Deir
3. Gayara
4. Nineveli
5. Kerkuk
6. Kifri
7. Mandali

PERSIA

1. Maidan-i-Napthun
2. Kirmanshah
3. Musjid-i-Suleiman
4. White Oil Springs
5. Qasr-i-Shirin
6. Quihm Island
7. Daliki
8. Lake Urumieh Region
9. Anzeli
10. Shaktesar
11. Gumush Tepe
12. Schahkuh-i-balae
13. Semnan

AFGHANISTAN

1. Kabul
2. Herat

INDIA

1. Yenangyat-Singu
2. Yenangyaung
3. Yenan
4. Baranga
5. Cheduba
6. Makum
7. Gara Hills
8. Chittagong
9. Rawal Pindi
10. Rohri
11. Mogalkot
12. Khatan

CHINA

1. Huisan Mountain Region
2. Yenchang
3. Ningtiaoliang
4. Nanchung Mountain Region
5. Cheekong

6. Ponkki
7. Szuchuan
8. Fu-chuan
9. Foo-choo-koo
10. Tai-li-cheu

JAPAN

1. Kurokawa
2. Niitzu
3. Nagano
4. Sagara

PHILIPPINE ISLANDS

1. Macabebe
2. Manalan
3. Santo Tomas
4. Bondac
5. Dumarao
6. Iloilo
7. Toledo
8. Vielaba
9. Lake Lanao

DUTCH EAST INDIES

1. Balik Papan
2. Tarakan Island
3. Banjermassin
4. Samarang
5. Madura Island
6. Idi
7. Lepan, Beritag
8. Palembang
9. Djambi
10. Celebes Island
11. Buti River
12. Iwaka River
13. Abai
14. Brunei
15. Miri

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